RADIOLOGY

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EDITOR

Howard P. Doub, M.D.
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Vol. 67 JULY 1956 No. 1

Irradiation and Surgery in the Management of Invasive Carcinoma of the Cervix[1]

FREDERICK W. O'BRIEN, Jr., M.D.,[2] and FREDERICK W. O'BRIEN, M.D.[3]

WITH THE publication of Meigs' (1) paper in 1947, in which he reported 91 operations of the Wertheim-Taussig type for cancer of the cervix with no mortality, interest in attempted surgical cure of this disease was revived. No one since has worked more industriously or with greater surgical acumen to establish surgery as a method of choice in cervical carcinoma. Many have failed, however, to heed Cade's warning (2) that this operation is admittedly not one for the "occasional hysterectomist," and as many have neglected to follow Meigs' selectivity in choice of patients, with dire results.

The operation as now performed, Meigs (3) writes, does not compare to surgery performed early in the series. The newer operation is attended by a higher incidence of nerve injuries to the bladder than the earlier procedure. As described by Meigs, his new operation could be done only in a department that has large grants for cancer research, or is similarly endowed; the preoperative preparation of the patient, the surgical teamwork, the nursing aftercare, and follow-up are fabulous. According to him, the total number of cases in which the procedure has been used is too few for sweeping deductions, but it is evident that surgical treatment alone, as far as cure is concerned and in respect to results in patients with positive nodes, *is as good as and even slightly better* (italics ours) than combined treatment with radium or x-ray and surgery.

Liu and Meigs (4), in a recent report on 344 patients with primary invasive carcinoma of the cervix, selected 193 who had been operated upon and followed for five years or more. One hundred and thirty-nine were classified clinically as Stage I; 53 as Stage II; 1 as Stage III. Among this total of 193 cases were 49 with regional lymph node metastases, showing a 35 per cent five-year survival (17 patients); 144 had no lymph node involvement, with an 81 per cent five-year survival (116 patients). We see no evidence here that surgery is superior to radiation.

One argument for surgery has been that radiation does not affect the pelvic nodes. Accumulated evidence now controverts this old idea. Graham and Graham (5) state that metastases from uterine cervical cancer occur with greater frequency in the regional nodes than more distantly. They review the work of Morton, Gorton, Cherry, Glücksmann, Dearing, and Way and conclude that the array of evidence

[1] Presented at the Forty-first Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 11–16, 1955.

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thus obtained suggests that radiotherapy does control regional node metastases in cervical cancer in part of the patients.

Glücksmann (6), in 1941, in a preliminary report from the Strangeways Research Laboratory, Cambridge, described a method by which the effects of radiation on malignant cells *in vivo* are measured quantitatively. The method consisted of counting the entire cell population of selected young areas in biopsy specimens taken before and after irradiation. Glücksmann believed it would provide the radiotherapist with a useful and fairly rapid method for obtaining information concerning the biological activity of an unirradiated tumor, and the efficacy of the radiation technic applied to the particular tumor under observation.

Similarly, the Grahams (7) have developed a cytological test, the so-called vaginal smear, which they believe shows a correlation between basal cells, the sensitization response, and positive nodes. Basal cells are the transitional cells of histologic terminology and are prevalent in the absence of estrogen or under the influence of androgens. In Stage I, these workers state, it is evident that the proportion of basal cells present has little influence on the cure rate for either radiotherapy or surgery. In Stage II, the trend is toward a better cure rate with radiotherapy if the smear contains many basal cells. The opposite is true of surgically treated patients, those with few basal cells enjoying a more favorable prognosis.

Thus, any group of cases with a high incidence of positive nodes would have a poor surgical cure rate. The opposite trend in the cases treated radiologically implies that positive nodes are less deleterious in radiotherapy and suggests that irradiation cures at least a portion of those with lymphatic involvement.

In some patients the basal cells show a characteristic alteration known as the sensitization response (SR). This takes the form of a dense basophilic cytoplasm that is finally vacuolated. If 10 per cent of the benign epithelial cells show this picture, the patient is said to have a marked SR. If the incidence is no more than 9 per cent, the patient is classified as having a poor SR. This phenomenon is called the sensitization response since patients exhibiting it are more likely to be sensitive to irradiation and to show a favorable response to therapy.

The Grahams reviewed 136 cases of cervical cancer treated radiologically and followed for five years, in which the pretreatment vaginal smears had been analyzed for SR. Their series included only 35 Stage I cases, since many of the patients in that stage were treated surgically. The cure of 7 patients out of 12 with marked SR is only modestly better than 6 out of 23 with poor SR. The salvage in the former group, however, is impaired by the loss of 3 patients with radiation damage. Of 65 Stage II patients, 30 had a marked SR and, of these, 24, or 80 per cent, survived, while of the 35 with a poor SR, only 8, or 23 per cent, survived for five years.

These writers go on to say that, of 80 patients with poor SR in whom a radical hysterectomy was done, 57 or 71 per cent survived for two to five years. There is a principle that only like things are comparable. In this instance, five-year radiation survivals are being compared with two- to five-year surgical survivals!

Another striking statement made by the Grahams is that, if the survival rate for all cases with marked SR is compared with the survival rate for all cases showing no SR, without taking into consideration the kind of therapy, no difference is found. Fifty-five per cent of the patients with no SR survived and 62 per cent with marked SR. In a series of 29 Stage II cases treated surgically, 13 survived, a survival rate of 45 per cent, while of 65 Stage II patients treated radiologically, 32 survived (or 49 per cent). At first glance, say the writers, radiation might appear to give slightly better results, but when the standard error is considered, it is apparent that there is no real difference between the

two groups. There is one difference, however, that strikes us, namely, that they compare 29 patients and 65 patients. One also wonders what happens to the standard error between 9 per cent SR and 10 per cent SR. We then learn that the vaginal smear in Stage I cases is of no real value, for in Stage I there is no difference in the salvage rate between those with many and those with few basal cells.

More recently, the Grahams (8) have described a cytological response during radiotherapy comparable to but somewhat more precise than SR. It is referred to as a radiation reaction, or RR. The five-year results in 142 cases treated radiologically and evaluated in this manner showed a 65 per cent cure rate in patients with a good RR, and a cure rate of only 8 per cent in those with a poor RR. It is not considered necessary to wait until the entire course of radiation has been given, for one can accurately evaluate the response midway. At that point, some other method of treatment, such as surgery, may be selected, or an attempt may be made to make the irradiation more effective. One approach to the latter end is to make the tumor more vulnerable so that it will succumb more readily to the roentgen rays and radium.

The observation that changes in the non-malignant epithelial cells are of importance in prognosis suggests to the writers cited above one of two possibilities: the host and the tumor share a common sensitivity to irradiation or the host response to irradiation is a major factor in the control of cancer; either or both of these may apply. A change in the patient's sensitivity to irradiation should be reflected in a parallel change in the response of the tumor. If the patient could be made more sensitive, corresponding improvement in the tumor response would be observed, if this interpretation is correct.

How may one alter the sensitivity of an individual to irradiation? According to the Grahams, there are actually several agents that apparently have this effect. Two that have been used are testosterone propionate given intramuscularly, 25 to 50 mg. every other day, and alpha-tocopherol, 100 mg. daily by motuh. These agents were given to a series of patients who showed a poor cytological response during the initial phase of their radiotherapy. In a series studied at the Radiumhemmet in Stockholm, of 99 consecutive cases treated radiologically, 39 were found to have a spontaneously good cytological response while 60 had an initially poor cytological response. Of the latter group of patients, 51 received supplemental medication, tocopherol or testosterone, during the remainder of the course of radiotherapy, and of these 33 ultimately attained a good level of RR; 13 failed to reach 75 per cent cells showing radiation effect, and in 5 the slides were broken before studies could be completed. "Obviously," continue the Grahams, "the results of treatment cannot be evaluated in one year, but the trend is suggestive . . . this series does establish that a poor cytological response may be changed to good in almost three-quarters of the cases given supplemental medication." As work progresses, we are impressed more and more with the value of radiation therapy intelligently administered.

We shall mention carcinoma *in situ* only to dismiss it. Meigs (9) gives a glossary of terms used to describe it, the majority of which certainly do not refer to carcinoma in any form. Indeed, McKelvey is quoted as questioning whether there really is such an entity as carcinoma *in situ*, and Novak is said to support the idea that the real nature of carcinoma *in situ* is unknown. Fennell and Castleman (10) in some cases see it as a reversible process. Hence, surgical statistics that group Stage 0 and Stage I together may be looked upon with justified suspicion.

From the foregoing, we see no evidence to alter our belief that radium and external radiation constitute the most effective modalities in the management of invasive carcinoma of the uterine cervix. The ease of radium application and the

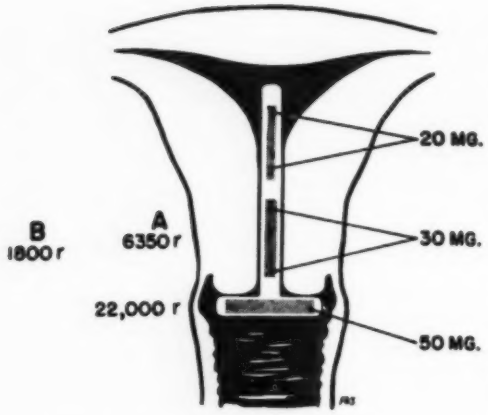

Fig. 1. Loading of the Clark applicator.

availability of deep roentgen therapy or comparable external radiation make these tools more universally workable than any other combination in the clinician's armamentarium.

We think it is important, however, that the clinical radiotherapist should devote a very special effort to combat the current attitude that the treatment of cancer of the cervix is a routine procedure. Each patient must be carefully evaluated and clinically staged. The League of Nations classification referring to the palpable and visible extent of the disease is almost trite, but is apparently novel to many who still confuse grade with stage. Its virtue lies in its simplicity of format. True, there are subdivisions, but they become academic in a larger sense when the spread of uterine cancer is considered as a whole. Unless lesions are clinically staged, statistical reviews become meaningless.

Meigs and Brunschwig (11), following Bonney (12), suggest a surgical classification. This is all well and good, but does not aid the examiner in deciding what treatment is indicated and in what stage to classify the disease. It merely points out the fact that the size of the initial tumor may not be related to its extent.

RADIUM THERAPY

Radium is used intracavitarily and vaginally. This distribution is designed to deliver a tumor-lethal dose to the cervix, endocervix, cervical canal, vaginal apex, paracervical triangle, and the adjacent parametrium, to be augmented in the last area by external radiation.

To be determined, or better still predetermined, is the number of milligrams of radium element, distributed as above, in relation to the total treatment time, to deliver a dose of 6,000 to 8,000 gamma r to Tod's point A. This may be accomplished in several ways. As a statement of fact, it is valueless unless accompanied by a description of the amount, filtration, distribution, and time of application. At this point, we would like to refer to a paper of Reeves (13), which we believe is basic. The ureter passes under the uterine artery at point A and, for this reason, its importance in dosimetry is underscored. Actually, any anatomical region may be used to determine tissue dosage, provided it can be consistently reproduced in an average number of cases. The anterior rectal wall and bladder wall are susceptible both to mensuration and necrosis. The one is done to prevent the other.

How will the radium be distributed? For the most part, this will depend on the individual radiotherapist and the system most successful in his hands. It is to be stressed here that the simpler the method the more uniform will be the results. Relevant to this is the increasing awareness of the variety of anatomical configurations encountered which preclude the use of many of the present-day geometrically conceived applicators. Certainly, the cancer therapist has to be familiar with one or two methods and have a working knowledge of others to compensate for these variations in the female anatomy.

We prefer the Clark or inverted T applicator and the Ernst device. The former is adaptable to Stage I and some early Stage II lesions, while the latter is flexible enough for either stage. Both combine simplicity of design with ease of operation. The units are multiple-piece affairs and serviceable, even though com-

plete dilatation of the canal is impossible or vaginal stenosis is present.

Figure 1 illustrates the loading of the Clark applicator as used by the authors whenever possible. There are 50 mg. of radium in the cross bar, 30 mg. in the endocervical section, and 20 mg. in the uterine canal. The 90 mg. loading as described by Ernst is followed by us, when feasible. Both units can be held in satisfactory position by proper packing, and the necessity of sutures is eliminated. This is attested both by radiographs on the day of application and follow-up films on the day of radium removal.

Packing deserves more attention than it is accorded. It is desirable to pack the cervix away from the bladder and the rectum without disturbing the position of radium sources. Unless the packing is thorough and done unhurriedly, there is no insurance that the radium will not slip or rotate on its axis. We use a two-inch strip of iodoform gauze or a Weston pack. This procedure is another argument in favor of compact radium applicators. The more instruments occupying the vagina, the harder it is to obtain uniform packing. We do not use an indwelling catheter and have never encountered any serious bladder infection. All patients are on strict bed rest during the radium seance and all have voided voluntarily.

Anteroposterior and lateral roentgenograms of the pelvis are taken almost immediately after radium application in the x-ray department. An air-filled Foley catheter is placed in the bladder and barium is instilled rectally. This gives an immediate check of relationships and sets up the patient for dosage measurements. It occasionally points to retroversion or anteversion of the uterus, which would certainly alter the overall time of the seance. Our measurements are based on Quimby's table for linear sources and apply only where these obtain. For other patterns, *viz.*, needles and the like, reference need be made to the table for volume dose.

Geometry of the uterus and pelvis is certainly of importance, but idealization

Fig. 2. Average tissue doses based on three years experience with the Clark applicator.

of geometry can be carried too far in our opinion, as described by Lewis *et al.* (14), who use a special table to determine the location of the radium sources, multiple films being obtained before and after application, and reduced to size by use of a Pantograph.

Figure 2 represents average tissue doses based on calculations of over sixty Clark applications made during the past three years. These figures were corroborated by Loehr, former Chief of Radiology, Murphy General Hospital. The procedure is the aggregate of thirty years experience which has given consistently good results without excessive damage to the normal tissues. This, then, is a retrospective or confirmatory analysis of a system used by the senior author, which depended largely on clinical judgment for its success. The latter day efforts of the physicist have more than justified its continued usage.

The Ernst applicator is familiar to all. Its loading will depend on the length of the cervical canal and the anatomical configuration of the vagina. We prefer to use a single application for each device. There is less likelihood of error in distribution. It is easier and more economical for the patient; it has not produced any undesirable effects, and it more closely

approximates the ideal in cancer therapy. Multiple applications, while worthwhile in their intent to irradiate tissue more slowly, often fail because the second and third seances frequently become more difficult as edema, fibrosis, and occasionally frank infection supervene.

The utility of the Ernst device stems from its attached vaginal arms, which allow a fairly even dose distribution with little chance of motion. The Birmingham spools have been used by one of us with the Clark applicator in Stage II cases. Spring colpostats have always seemed to us just a little insecure. A far better way to supplement or intensify parametrial reaction is by external irradiation or the needle method, so admirably practiced in this country by Waterman. The latter is not for the uninitiated.

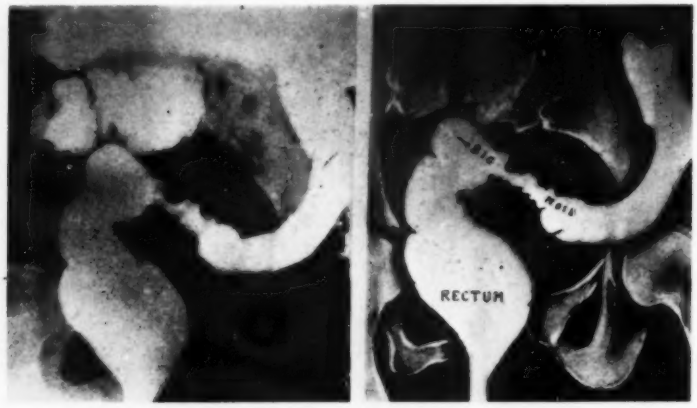

Fig. 3. Stricture of sigmoid following irradiation.

To summarize, intracavitary and vaginal radium form the foundation stones of therapeusis in cancer of the cervix. Distribution, time, packing, roentgenograms, mensuration, and attention to one familiar method are requisites. We have not intentionally ignored the contribution of others, but the time does not permit recapitulation. For those interested, the historical review (15) by the senior author is suggested reading.

ROENTGEN THERAPY

External irradiation is complementary to radium, its purpose being to bring up the dose in the parametrium. Some use it prior to radium. We prefer to give the pelvic cycle about three weeks after radium application, when practicable. A review by Baud (16) of 3,327 cases of epithelioma of the uterine cervix treated from 1919 to 1947 at the Curie Foundation showed a remarkable increase in the five-year cure rate, especially in Stages I and II, once external irradiation was added to intracavitary radium.

To most of us, 200 to 400 kvp are the only potentials available for deep therapy. This means that some ingenuity and judgment will have to be used in treatment planning. As a rule, four and sometimes six portals are used, depending on the size of the patient. Our external irradiation extends over ten weeks, in keeping with our practice of low total dosage, particularly in Stages I and II, where we depend on radium to carry the bulk of the load. The problem is different when more advanced cases are considered. About these, something will be said later.

Even in carefully planned therapy complications ensue. Ten to fifteen days after radium treatment, transient diarrhea and tenesmus may occur. Bladder symptoms are minimal. They should respond to supportive measures. Bloody diarrhea is an ominous sign and bears serious investigation. Large bowel or vesical necro-

sis may appear anywhere from six months to ten years following treatment (Figs. 3 and 4). Fistulas, pyometra, and other sequelae are rare occurrences. Infection, which once was a serious complication, is now offset by the discerning use of antibiotics.

During deep therapy, such systemic effects as nausea, diarrhea, and anorexia have been rare in our experience, since all patients are placed on B-complex, three times daily, during treatment. Every side effect is not necessarily related to radium or x-rays. By its very nature, cervical cancer more than any other disease remains localized in the pelvis for long periods of time, invading adjacent tissue planes by continuity, contiguity, and direct extension. The disease itself is responsible for fistulas, ureteral obstruction, and necrosis out of all proportion to alleged radium mischief.

Oftentimes after treatment the patient is left to drift for herself; follow-up is too casual, and local recurrences or radiation sequelae are not discovered in a curable stage. The follow-up should consist of a complete pelvic examination, Papanicolaou smears, biopsy, and other diagnostic procedures on a monthly basis. This cannot be left to the patient's discretion; insistence upon it should be in the domain of all who are treating cancer.

Recurrences, as a rule, are not fertile ground for retreatment with radium. Their management requires the closest cooperation of the pathologist, cytologist, cancer surgeon, and radiotherapist. Occasionally, radium therapy may be repeated, but this must be considered as a calculated risk. More feasible, perhaps, is surgical intervention in rigidly selected cases. This does not imply the pelvic sweep of Brunschwig. We are opposed to mutilation.

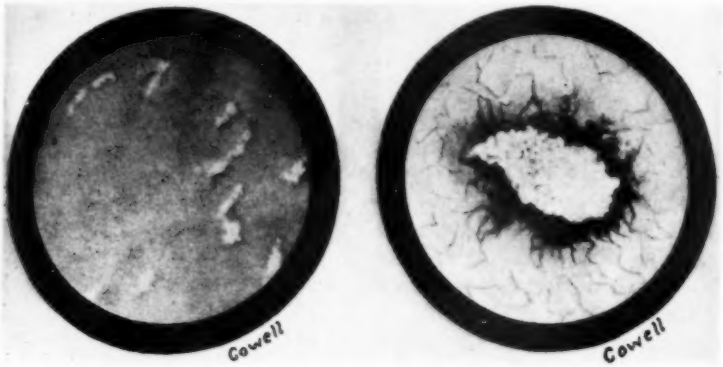

Fig. 4. Cystoscopic views of acute cystitis (left) and chronic radiation ulcer (right).

In Stage III and IV cases we prefer transvaginal irradiation with supplementary external irradiation. In private practice we have used 400 kv, h.v.l. 5 mm. Cu, since 1937. One of us has had five years experience with 2-MEV apparatus, which makes it possible to deliver to the entire pelvis a tumor dose of between 6,000 and 8,000 r in thirty to forty days for a daily tumor dose of 200 to 250 r. It must be remembered that this dose is fairly uniform throughout the pelvis and bladder, and the rectal mucosa will share this level. Such treatment can be an important adjuvant when used in a limited fashion in the later stages of cancer of the cervix. This is not to say that equally good results may not be had with the 50-gram radium unit or with cobalt teletherapy. What is fundamental is that the physical characteristics of the apparatus be understood by the therapist and that he have clinical experience in cancer therapy with conven-

tional as well as with ultrashort-wave radiation, else he will have to learn the hard way the value of Stone's dictum that what one does not get on the skin, one gets below.

We have not considered radioactive cobalt needles, colloidal gold or radioactive gold pellets, as used in the endocervix or parametrium. These radioactive modalities have yet to prove their superiority. We purposely have omitted survival statistics from the great radiation centers on the Continent and in this country, since they are readily available and comparable to those of any surgical group. We have endeavored to evaluate radical surgery and the cytological tests fostered especially in our city (Boston), and to present what to us is a simple and adequate radiation program for treatment of carcinoma of the cervix.

Bonney (12), the prototype of our surgical confreres, reported 500 Wertheim operations for carcinoma of the cervix with a 40 per cent five-year cure rate and stated, "the results of radiation on the other hand have steadily improved and, at the present time, the best of them appear equal to the best results of the surgeon." This statement was published in 1941 and, as far as we have been able to learn, still holds good. We would like to conclude with a thought expressed several years ago by Corscaden (17), who quoted Fletcher Shaw to the effect that radium offers the best chance of cure, as well as being the most humane method of treatment in cancer of the cervix.

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SUMARIO

La Irradiación y la Cirugía en la Asistencia del Carcinoma Invasor del Cuello Uterino

Repasada la literatura acerca del tratamiento operatorio del cáncer cervical, no encontraron los AA. dato alguno que alterara su opinión de que el radio y la irradiación externa constituyen los medios más eficaces para tratar la dolencia. La fácil aplicación del radio y la accesibilidad de la roentgenoterapia profunda o la radiación externa comparable hacen que estos procedimientos encuentren aplicación más universal que las otras medidas.

El radio—intracavitario e intravaginal—constituye el cimiento de la terapéutica en el cáncer del cuello uterino. El aplicador de Clark o en T invertida y el de Ernst son los preferidos debido a su sencillez. A ambos puede mantenérseles en posición con un taponamiento apropiado, cuya importancia se recalca. La irradiación externa como procedimiento complementario está destinada a aumentar la dosis en el parametrio. Los AA. prefieren usarla unas tres semanas después de terminar la curieterapia, haciéndola durar diez semanas.

Para los casos de los Períodos III y IV, se prefiere la irradiación transvaginal, complementada con la irradiación externa. En su práctica particular, los AA. han usado 400 kv, con capa de hemirreducción de 5 mm. de cobre.

Se discuten las pruebas citológicas como guía de la terapéutica y del pronóstico y métodos para acrecentar la susceptibilidad a la irradiación.

Idiopathic Coxa Vara in Childhood[1]

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IDIOPATHIC coxa vara in children may be seen either as a congenital malformation or a developmental change in the proximal femur. In the literature, these cases are usually discussed under the headings "congenital coxa vara," "infantile coxa vara," "cervical coxa vara," or "developmental coxa vara."

Idiopathic coxa vara in childhood was first described by Hofmeister (1) in 1894 and Kredel (2) in 1896. Reviews of the subject were published by Zadek (3) in 1935 and Babb, Ghormley, and Chatterton (4) in 1949. Many recent case reports and analyses of treatment have appeared in orthopedic and surgical journals (5–11) but few are to be found in the radiologic literature. Heublein, Bernstein, and Hubenet (12) include "congenital coxa vara" in a discussion of *Hip Lesions of Infants and Children*. Clark and Jacobson (13) consider the clinical and roentgen features of congenital coxa vara as indicative of an osteochondrodysplasia of the femoral neck. Brailsford (14) describes the radiographic features of the condition in full.

Coxa vara in children is the result of a diminution in the angle of inclination of the femoral neck and shaft below the normal 120°. The classification proposed by Fairbank (15) in 1928, which is most useful from a radiologic point of view, may be modified as follows:

Idiopathic:

(*a*) *Congenital:* Mild or severe coxa vara, with associated congenital anomalies such as dislocation of hip, faulty development of thefe mur, craniocleidodysostosis, etc.

(*b*) *Developmental:* Progressive, usually appearing between the ages of two and six years, with characteristic roentgenologic features.

Rachitic: Usually associated with active rickets.

Adolescent: Secondary to slipped capital femoral epiphysis.

Traumatic: Usually following fracture of the femoral neck (rare in children).

Inflammatory: Secondary to tuberculosis or other infection.

Other Underlying Bone Diseases: Osteogenesis imperfecta, cretinism, dyschondroplasia, Paget's disease, osteoporosis, etc.

Capital Coxa Vara: Occasionally seen in severe osteoarthritis and Legg-Perthes' disease.

In congenital coxa vara, associated congenital anomalies are characteristically present, particularly in the hip or femur. This type of coxa vara is usually recognized at birth or shortly thereafter. In the developmental type, congenital anomalies are less evident, and the process is not apparent until the age of three or four years. Duncan (16) states unequivocally that coxa vara found after the age of four without associated congenital anomalies is always developmental.

It is important to differentiate these two main groups of idiopathic coxa vara in childhood. As Duncan points out, they are distinct, though they may represent different stages of the same process and thus have certain features in common. We are presenting here 7 cases of congenital

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coxa vara and 16 of developmental coxa vara, with a discussion of the clinical and roentgenographic features of each of the two types.

CLINICAL FEATURES

In the congenital group, the chief clinical features are related to such associated anomalies as shortening or deformity of the limb. Delay and difficulty in walking may be the presenting feature.

TABLE I: CLINICAL FEATURES IN TWENTY-THREE CASES OF COXA VARA

	Congenital Group (7 patients)	Developmental (Postnatal) Group (16 patients)	Total (23 patients)
Side involved			
Right	5	8	13
Left	1	2	3
Bilateral	1	6	7
Sex			
Male	3	4	7
Female	4	12	16
Race			
White	5	11	16
Negro	2	5	7
Symptoms			
Limp	5	11	16
Pain	1	8	9
Waddling gait	1	5	6
Shortened extremity	6	11	17

Many of the patients in the developmental group limp from infancy, differing from the congenital group only in the absence of other congenital anomalies. This indicates the close relationship between the two groups. Frequently, the disturbance in gait is not noted until after the age of four.

Pain is not a prominent symptom until walking and weight-bearing have produced secondary changes. In bilateral cases, a characteristic waddle and pronounced lumbar lordosis are observed, similar to the findings in congenital dislocation of the hips.

In both groups, limp is associated with noticeable shortening on the affected side. Elevation of the trochanters, limitation of extension and rotation at the hip, and a positive Trendelenburg sign are the chief findings on physical examination.

TABLE II: PERTINENT PHYSICAL FINDINGS IN TWENTY-THREE CASES OF COXA VARA

	Congenital Group (7 patients)	Developmental (Postnatal) Group (16 patients)
External rotation of hip	2	2
Flexion contraction of hip	2	3
Limitation of abduction of hip	3	12
Limitation of external rotation of hip	0	4
Limitation of internal rotation of hip	2	9
Limitation of extension of hip	0	2
Prominent greater trochanters	0	1
Increased lumbar lordosis	0	4
Shortening of lower extremity	6	10
Genu valgum	0	2

NOTE: Multiple findings were present in many patients.

A rather striking predilection for right-sided involvement was noted in both congenital and developmental coxa vara (Table I). In 6 of the 16 patients in the latter group the condition was bilateral, while there was but 1 bilateral case among the 7 with congenital disease. The sex incidence was rather striking, with a considerable preponderance of females in the developmental group. There were more than twice as many whites as Negroes in both groups but, because of the larger percentage of white patient population with which we were dealing, this may not be significant.

The symptoms are shown in Table I. Limp and shortening of the involved extremity were common features in both groups. The pertinent physical findings, relating chiefly to the extremities, are summarized in Table II.

In Figures 1 through 4 are shown examples of congenital coxa vara. Figures 5 through 10 demonstrate the appearance of developmental coxa vara.

ROENTGEN FEATURES

The roentgen features are similar in both groups of idiopathic coxa vara. The

Fig. 1. Right-sided congenital coxa vara with a shallow acetabulum without dislocation. The epiphyseal plate is almost vertically placed, and there is considerable metaphyseal irregularity. Acetabular dysplasia is apparent on the left.

Fig. 2. Congenital coxa vara with acetabular dysplasia and some subluxation. There are one or two loose bodies in the upper portion of the metaphyseal area. Considerable deformity of the femoral head is present. Note the elevated, beaked greater trochanter.

Fig. 3. Bilateral congenital coxa vara with acetabular dysplasia with no dislocation. The epiphyseal cartilage plate is almost vertical on both sides. A zone of bony density delimited by a curvilinear radiolucent area is demonstrated in the upper portion of the right femoral neck in the submetaphyseal area.

Fig. 4. Congenital left-sided coxa vara with concomitant shortening of the femoral shaft. A triangular radiolucent defect is visible in the inferior portion of the metaphyseal zone of the neck.

chief difference lies in the presence of other anomalies in the congenital type. These include acetabular dysplasia (Figs. 1–3), femoral shortening (Fig. 4), and multiple associated abnormalities.

By definition, coxa vara involves a diminution in the angle of inclination of the femoral neck and the shaft, below a normal of 120°. This diminution is generally considerably enhanced with weight-

Fig. 5. Extensive right-sided developmental coxa vara, with the epiphyseal cartilage plate practically vertical. There is considerable juxta-metaphyseal-epiphyseal irregularity, with a large triangular bone fragment situated inferiorly in the area of the epiphyseal cartilage plate.

Fig. 6. Severe bilateral developmental coxa vara, with epiphyseal cartilage plates vertically situated. Considerable juxta-metaphyseal-epiphyseal irregularity is present. There is definite beaking at the inferior margin of each metaphysis. A triangular bone fragment is seen in the upper margin of the metaphyseal-epiphyseal area on the right. The femoral neck shows shortening and some broadening. A stress fracture is seen on the left at the base of the neck.

Fig. 7. Bilateral developmental coxa vara with juxta-metaphyseal-epiphyseal irregularity and a bony spur in the inferior metaphyseal area on the left. There is considerable fragmentation, with apparent necrotic bodies in the femoral capital epiphysis.

Fig. 8. Same case as shown in Fig. 7, after bilateral subtrochanteric osteotomy; restitution toward normal right femoral capital epiphysis is demonstrated.

bearing, as the child grows older. It may be as little as 90°, or even less, in more advanced cases. As the angle between the femoral neck and femoral shaft approaches 90°, the epiphyseal cartilage plate assumes an increasingly vertical position. Associated with this change is the relative elevation of the greater trochanter, which often appears large and beaked (Fig. 10). In extreme instances, the beaked greater trochanter may impinge on the ilium, with formation of a pseudarthrosis.

In almost all patients there are irregularity and fragmentation of the metaphyseal-epiphyseal junction, and in many widening of the epiphyseal cartilage plate is seen (Figs. 5, 7, 9, and 10).

A triangular loose fragment is characteristic of idiopathic coxa vara and is observed in both the congenital (Figs. 2 and 3) and developmental (Figs. 5 and 6) types. It appears at either the superior or inferior margin at the junction of the neck and epiphyseal cartilage, resulting in the so-called "Y" or inverted "Y" appearance. The radiolucent line separating the tri-

Fig. 9. Severe bilateral developmental coxa vara, with vertical epiphyseal cartilage plate on the left. Each femoral neck is markedly shortened and deformed.

angular fragment has occasionally been misinterpreted as a fracture and may persist as a pseudarthrosis. In most cases, this characteristic radiolucent gap disappears with growth or after corrective surgery.

The femoral neck is usually short and deformed, occasionally almost completely absent (Figs. 2, 5, 7, and 9). In later stages, it may appear narrow and sclerotic (Fig. 6). The femoral head is of normal density but generally hypoplastic and slightly deformed (Fig. 7); occasionally it seems relatively large and flattened.

Beaking of the inferior metaphyseal margin is occasionally seen in the more severe deformities (Figs. 1, 6, 7, and 10). This is usually associated with sclerotic stress changes along the inferior margin of the femoral neck. Similar stress changes are noted along the medial margin of the proximal femoral shaft. In rare instances, these changes are accompanied by "stress fractures" at the angle of the neck with the shaft (Fig. 6) or along the medial border of the proximal femoral shaft (Fig. 10).

The head of the femur usually impinges on the inferior margin of the acetabulum in coxa vara, and secondary developmental changes may occur in the untreated case.

PATHOLOGY AND PATHOGENESIS

There is a large volume of literature on the pathogenesis and the pathologic changes observed in idiopathic coxa vara of childhood. Most of this literature is quite confusing, and concrete information is difficult to obtain. We have discussed the problem with Dr. Henry L. Jaffe, Director of Pathology at the Hospital for Joint

Fig. 10. Right-sided developmental coxa vara showing a prominent elevated and beaked greater trochanter. There is a stress fracture in the area of the lesser trochanter.

Diseases, New York City, who was good enough to look over the material presented in this paper. In a study of pathologic sections taken from the femoral neck in cases of coxa vara in childhood in which osteotomy had been performed, he found nothing abnormal, either grossly or microscopically. A tenable hypothesis, advanced by Dr. Jaffe, is that the epiphyseal cartilage plate in the neck region becomes thickened, with a lack of ossification. The periosteum in this area is apparently deficient in laying down the cortex just beyond the head. There is primarily a lack of development of the neck, with the epiphyseal cartilage plate ultimately assuming a vertical position. A condition closely akin to pseudarthrosis develops. This type of defect is maintained as long as the epiphyseal cartilage plate continues to lay down cartilage cells. When this active process (epiphyseal growth) ceases, fusion occurs, and the disorder becomes stabilized. The loose bodies present may represent zones of ossification at the site of

the widened epiphyseal plate. Osteotomy may serve to reduce the motion and therefore aid in the healing of the pseudarthrosis. This hypothesis is apparently supported by our roentgen evidence and the few pathological specimens available.

TREATMENT

Mild cases with slight varus deformity and minimal osseous defect usually present few symptoms and may require no treatment. In most cases, however, if untreated, progressively severe varus deformity develops, with secondary osseous changes in the femoral neck (Fig. 3). In general, pseudarthrosis tends to occur if the angle of the neck of the femur with the shaft is less than 90° (Fig. 5).

The surgical treatment of choice is a subtrochanteric osteotomy at an early age (six to eight years), with correction of the varus deformity (Fig. 8). If the alignment of weight-bearing is improved, subsequent solidification of the femoral neck usually takes place (Fig. 8), with improvement in gait, length of leg, and symptomatology.

SUMMARY AND CONCLUSION

1. A series of 23 cases of idiopathic coxa vara in childhood has been collected. Of these, 7 were congenital in origin and 16 developmental. A tabular summary of the clinical data is given.

2. There are two main points of difference between the congenital and developmental groups. In the congenital cases the age of onset is earlier and there are associated anomalies. The developmental form does not usually occur until after the fourth year and other anomalies are not seen.

3. In each group the chief roentgen features, in addition to the coxa vara, are a vertical epiphyseal plate and elevation of the greater trochanter. The characteristic irregularity and fragmentation of the proximal metaphysis are often productive of a loose triangular fragment at the margin of the metaphysis and a short hypoplastic femoral neck.

4. The pathology and pathogenesis of idiopathic coxa vara are not clearly known. A tenable hypothesis suggests deficient osteogenesis in the femoral neck region, with development of "pseudarthrosis."

5. The optimum treatment, at present, appears to be a subtrochanteric osteotomy at an early age to promote solidification of the femoral neck with an improved alignment in weight-bearing.

ACKNOWLEDGMENT: We are indebted to Dr. Henry L. Jaffe, Director of Pathology, Hospital for Joint Diseases, New York, N. Y., for his kindness in evaluating our material and advancing a working hypothesis for the pathogenesis of idiopathic coxa vara in childhood.

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SUMARIO

Coxa Vara Idiopática en la Niñez

Preséntanse los hallazgos en una serie de 23 enfermos que tenían coxa vara idiopática en la niñez. De estos casos, 7 reconocían origen congénito y 16 eran de forma adquirida en el desarrollo. En los primeros, la edad a la iniciación es más temprana, y existen otras anomalías congénitas, mientras que en los últimos, la dolencia aparece generalmente después del cuarto año de vida, sin otras anomalías.

Además de la coxa vara, las principales características roentgenológicas en ambos grupos son una placa epifisaria vertical y elevación del trocánter mayor. La irregularidad y la fragmentación de la metáfisis proximal, hallazgo este típico, producen a menudo un fragmento triangular desprendido en el borde de la metáfisis y acortamiento hipoplásico del cuello del fémur.

No se conocen claramente la anatomopatología y la patogenia de la coxa vara idiopática. Una hipótesis sostenible sugiere osteogenia deficiente en la región del cuello femoral, con formación de seudoartrosis.

El tratamiento óptimo, en la actualidad, parece ser una osteotomía subtrocantérica a una edad temprana para fomentar la consolidación del cuello femoral con una alineamiento mejor para la carga del peso.

Cushing's Disease: Its Roentgenographic Findings[1]

C. C. WANG M.D., and LAURENCE L. ROBBINS, M.D.

CUSHING'S DISEASE, an unusual and complex endocrine disturbance, has been recognized in the past twenty years with increasing frequency. This increase in incidence, or in recognition, as well as the iatrogenic occurrence of the disease, warrants knowledge of its roentgenographic appearance. Relatively little, however, has appeared in the radiologic literature. The main roentgen features described are osteoporosis and associated fractures. Eisenhardt and Thompson (7), in a study of 61 patients, found the bones to be normal in only 3, the remainder showing definite to questionable osteoporosis. Sosman (8) reported 7 cases investigated from the diagnostic and therapeutic aspects, but critical appraisal of roentgenographic findings was not attempted. Sussman and Copleman (9) described osteoporosis in 6 of 7 cases reviewed, involving the skull, spine, and ribs, and in 1 instance the long bones. They emphasized, as "almost pathognomonic" for Cushing's disease, a peculiar, sharply defined, localized expansion of the lower ribs to about twice their normal diameter just lateral to the costochondral junction. This callus-like abnormality was indistinguishable either roentgenographically or histologically from callus resulting from fracture.

This bizarre and as yet poorly understood entity is of complicated etiological background, but is said to be due to hyperadrenocorticism resulting from pituitary basophilism, adrenal cortical hyperplasia, adenoma, or carcinoma. It is believed that the changes in bone are the result of a disturbance of protein metabolism leading to insufficient tissue repair and to lack of bony matrix formation and calcium deposition, resulting in osteoporosis (1, 3).

A typical full-blown case of Cushing's disease is easily recognized (2). It is characterized clinically by unusual deposition of fat chiefly limited to the face, neck, and trunk, producing the appearances commonly described as "moon face" and "buffalo hump." In contrast, the extremities are thin and wasted. The patients tend to have acne and atrophy of the skin with purplish striae of the abdominal wall, and to bruise easily. There are also undue fatigability, susceptibility to infection, hirsutism without virilism, amenorrhea, gonadal suppression, hypertension, and osteoporosis. The laboratory findings include glycosuria, a decreased sugar tolerance, slight polycythemia, and mild leukocytosis with lymphopenia and eosinopenia. The serum calcium and phosphorus are normal.

The present study is based on a review of the roentgenograms of 38 patients with Cushing's disease. The first diagnosis of this condition was made at the Massachusetts General Hospital in 1935, and in the subsequent twenty years 49 patients with the disease were admitted. For 38, roentgenograms are available and the findings are herewith presented.[2]

The significant roentgenographic findings can be arbitrarily divided into two categories: changes in bones and changes in soft tissues. These changes appear to be closely related to the severity and duration of the disease.

CHANGES IN BONES

Cushing's disease involves the bones of the entire skeleton. A patient with minor clinical manifestations may present no osseous changes, whereas an advanced case may show bony abnormality with widespread deformities. The basic proc-

[1] From the Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, Mass. Presented at the Forty-first Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 11–16, 1955.

[2] The clinical and therapeutic features of the group have been summarized by Cope and Raker (5).

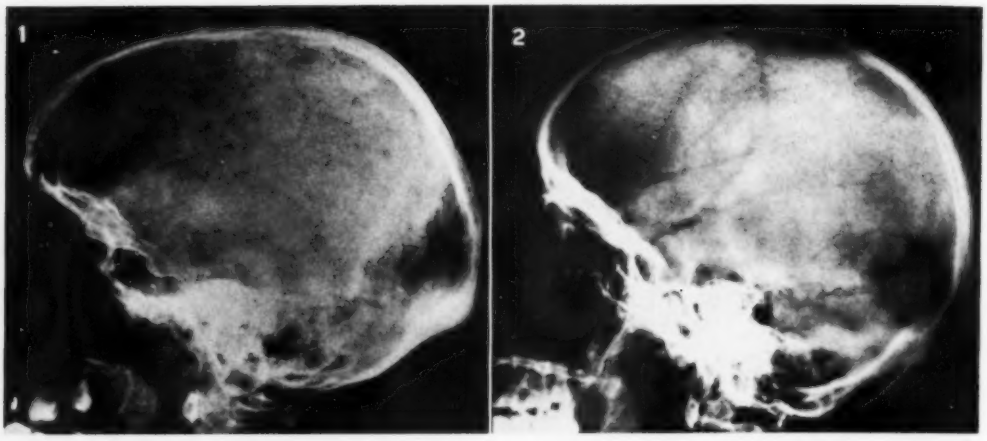

Fig. 1. Case 19. A female, 37 years of age, who had had Cushing's disease for a year and a half, was found to have a left adrenal cortical adenoma. A roentgenogram of the skull showed marked patchy mottled rarefaction of the calvarium, not unlike that which may occur in mild hyperparathyroidism. The posterior clinoids and the dorsum sellae were also decalcified.

NOTE: The case numbers as given in all legends are based on the order in which the patients were admitted to the hospital. The same case numbers will be used in any future publications on Cushing's disease from this institution.

Fig. 2. Case 28. At operation, a 31-year-old female, having had symptoms of Cushing's disease for one year, was found to have a right adrenal adenoma. A roentgenogram of the skull revealed punctate, sandpaper-like osteoporosis of the frontal and parietal bones.

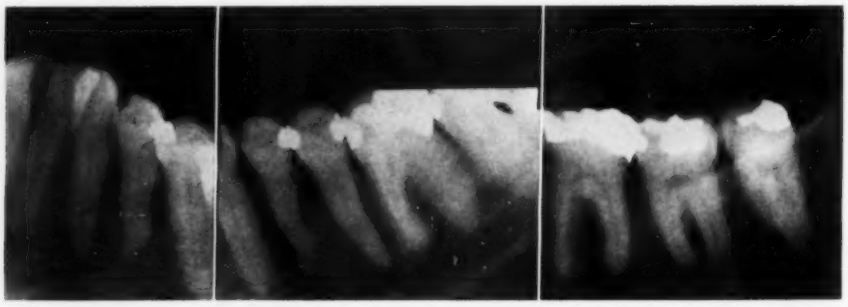

Fig. 3. Case 22. A 35-year-old female had had manifestations of Cushing's disease for seven years. Postmortem a right adrenal cortical adenoma was found. Intra-oral roentgenograms showed marked diminution and complete loss of the lamina dura about some of the individual teeth as a part of generalized osteoporosis. See also Figs. 4 and 7.

ess is generalized osteoporosis, particularly evident in the skull, spine, ribs, pelvis, and to a lesser extent the extremities, with attendant fractures and their complications.

In the *skull* the appearances vary from normal to an extremely unusual stippled osteoporosis. Of the 22 skulls examined, 4 showed no detectable bony abnormality, 5 diffuse mottled decalcification (Fig. 1), and 13 peculiar punctate, sandpaper-like, granular rarefactions, chiefly in the frontal and parietal bones (Fig. 2). These skull changes were not unlike the milder degree of involvement which may occur in hyperparathyroidism. The outer and inner tables were not thickened nor the diploic spaces widened. The posterior clinoids and/or the dorsum sellae were decalcified. It has been recognized that the pituitary basophilic adenomas are usually small and do not cause significant pressure on the surrounding structures. In all the cases examined, the sella turcica

appeared normal in size, with a single exception, in which there was questionable enlargement.

In no case did the teeth, which were examined in 5 patients, show complete loss of lamina dura. There was, however, marked diminution in the amount and

Fig. 4. Case 22. Osteoporosis of the spine with fine longitudinal hairline striations of increased density simulating hemangioma.

even absence of lamina dura about some individual teeth (Fig. 3).

In its mildest form osteoporosis of the *spine* is manifested as increased radiotransparency, with loss of the trabecular pattern and with relative prominence of the end plates of the vertebral bodies. Of the 32 patients whose spines were exam-

Fig. 5. Case 6. On admission an 11-year-old girl gave a history of Cushing's disease of three years duration. This was subsequently proved to be due to adrenal hyperplasia.

A. Roentgenogram of the spine showing severe osteoporosis with disk expansion and multiple compression fractures of the vertebrae.

B. Recalcification of the deformed osteoporotic vertebral bodies evident three years after roentgen therapy to the pituitary.

ined, 10 showed fine, vertical, linear striations of increased density in the bodies of the vertebrae, probably as a result of resorption of the finer trabeculae (Fig. 4). These hairline striations are somewhat similar in appearance to those which may be seen in hemangioma; the changes, however, are much less marked, and the striations are finer. Marked osteoporosis resulted in fractures which were characterized by (*a*) wedging of the vertebrae, more frequently seen in the mid thoracic than in the lumbar spine; (*b*) anterior buckling or slight localized

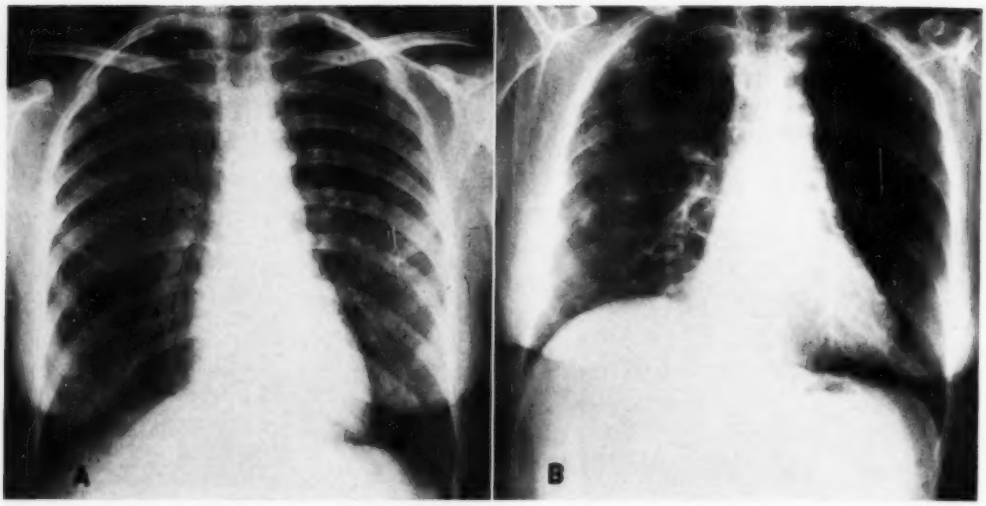

Fig. 6. Case 31. A 25-year-old female for nine months prior to entry had had symptoms as a result of adrenal hyperplasia.
A. Normal chest.
B. In the subsequent four years, during ineffective therapy, multiple rib fractures occurred. Roentgenographically the fractures were seen to be surrounded by dense callus which, in contrast with the osteoporotic ribs, presented a "cotton-wool" appearance.

bulging of the mid-anterior surface of the vertebral bodies (seen in 3 patients); (*c*) isolated crush fracture of one or more vertebrae; (*d*) expansion of the vertebral disks into the adjacent bones, with multiple compression fractures (Fig. 5A). These last findings were seen in the lumbar spine in 15 of the 32 patients examined, and in the thoracic spine in 11 of 31 patients. In the extreme degree, the "fish-bone" vertebra was found.

The *pelvis* shares in the generalized osteoporosis and its accompanying complications, but the changes are usually less marked and less detectable than those in the spine. Of 35 roentgenograms of the pelvis, 15 revealed slight to moderate decalcification, and in 3 there was marked osteoporosis associated with spontaneous fractures in the ascending and descending rami of the pubic bones with abundant surrounding callus. Acetabular protrusion was found in 1 patient and in another there were multiple rarefactions simulating metastases. The remainder of the group showed no evidence of osteoporosis and were considered normal in this respect.

Osteoporosis of the *ribs* may be manifested by increased radiolucency, coarsening of the bony trabeculae, and fractures. The ribs were considered to be normal in 11 of 37 patients; in 26 there was slight to moderate osteoporosis. Of this latter group, 14 had multiple fractures. These fractures may have been recent or old and were surrounded by excess callus. In contrast to the adjacent osteoporotic bones, this dense callus was quite striking, at times presenting a cotton-wool appearance (Fig. 6). In 3 patients expansion of the anterior ends of the ribs or enlargement of the costochondral junction was evident. These changes are probably due to multiple strain infractions near the costochondral junction with partial separation of the fragments.

It has been said that the osteoporosis in Cushing's disease rarely involves the long bones of the extremities. In 7 of 10 cases of this series, however, the bones of the extremities showed a certain degree of osteoporosis but less marked than that seen in the skull, spine, and pelvis. The changes consisted of thinning of the cortex,

increased radiolucency, and in severe cases fracture. In one instance, bilateral fractures of the fibulae were seen (Fig. 7). No cystic lesions in the bones were encountered.

It is interesting to note that 2 patients of the group showed osteochondritis, 1 in the second metatarsal head (Freiberg's disease) and 1 in both femoral capital epiphyses (Legg-Perthes' disease). It is not clear whether this abnormality is related to Cushing's disease or is purely coincidental.

Except in growing patients, whether treatment is by surgery or radiation, recalcification of the osteoporotic bones may not be demonstrable for years after clinical recovery (Fig. 5B).

Fig. 7. Case 22. Severe osteoporosis of the leg with fractures of the proximal fibulae. The cortex is thin and the bony trabeculae are coarsened.

SOFT-TISSUE CHANGES

Over and above those soft-tissue changes clinically evident, certain others may be demonstrated roentgenologically. Probably the most common, and one almost universally found in Cushing's disease, is enlargement of the heart associated with hypertension. After effective treatment either by surgery or radiation, the heart may return to normal size (Fig. 8). In 4 patients, calcification of the abdominal aorta and its branches occurred disproportionately early in life (Fig. 9). Whether this was related to a negative calcium balance or to diabetes is not clear. In 2 cases calcification in the periarticular soft tissues of the hands was found, not unlike that seen in hyperparathyroidism or vitamin D intoxication (Fig. 10). Adiposity, in the form of large amounts of fat interposed

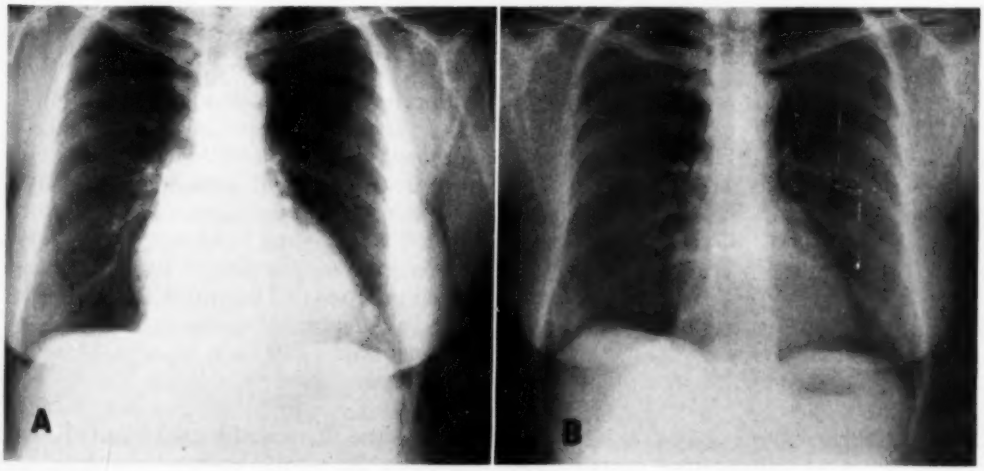

Fig. 8. Case 23. A 33-year-old female gave a two and a half year history of Cushing's disease with hypertension.
A. Enlargement of the heart.
B. The heart returned to normal size with the decrease of blood pressure three years after successful treatment.

between the muscle bundles of the body, and muscular atrophy of the extremities were readily visualized roentgenographically.

The structure primarily involved in the production of Cushing's disease is the adrenal gland. Its enlargement may represent (*a*) carcinoma, producing a fairly large soft-tissue mass with atrophy of the opposite adrenal (Fig. 11); (*b*) an adenoma of lesser size (in this series, exclusively in females); (*c*) bilateral hyperplasia with only slight actual increase in size of the glands. These abnormalities may be demonstrated by appropriate technics, including plain roentgenography of the upper abdomen, laminagraphy, abdominal aortography, and retroperitoneal air insufflation (6). The last method, especially when combined with laminagraphy, is often the most informative, particularly in the presence of an adenoma or carcinoma (Fig. 12). In cases of hyperplasia, the findings are much less clear, and minor changes may be unrecognized; occasionally slight enlargement of both adrenals may be shown. No unusual calcification was seen in the adrenal region. The kidneys were normal in position except in the presence of a fair-sized adrenal tumor, in which event the kidney was displaced inferiorly. Renal stones were found in 13 of the 38 patients examined. The stones, both unilateral and bilateral, usually appeared to be small, semi-opaque, and few in number. They were not easily demonstrable unless films were of good quality. There was no significant impairment of renal function. The full-blown appearance of nephrocalcinosis has not been encountered.

Fig. 9. Case 16. Marked calcification in the femoral arteries in a 42-year-old female who had had Cushing's disease for six years.

DISCUSSION

Since the therapeutic use of ACTH and cortisone in a wide variety of conditions has become extensive, a number of cases with iatrogenic Cushing's disease have been observed. These patients present

profound changes in the bones and soft tissues similar to those described above. This fact points to the additional need of their prompt roentgenologic recognition, making it a matter not merely of academic interest but of practical value.

Fig. 10. Case 15. A 31-year-old-male in whom Cushing's disease had been recognized for two or three years presented unusual calcification in the periarticular soft tissue of the hand. He also had renal stones.

The manifestations of osteoporosis in Cushing's disease present problems of differential diagnoses, particularly those of hyperparathyroidism, postmenopausal osteoporosis, osteomalacia, and diffuse malignant involvement of bone. In hyperparathyroidism there is generalized decalcification with or without cyst formation in the entire skeleton. The enlarged parathyroid glands may be visualized by adequate roentgenographic examination (10). In this series, roentgenograms of the hands and feet showed no evidence of subperiosteal bone resorption, which is not uncommonly seen in hyperfunction of parathyroids. In Cushing's disease the frequent involvement of the skull is helpful

Fig. 11. Case 4. A large carcinoma of the left adrenal gland with diffuse metastases in a 56-year-old female who had presented symptoms and signs of Cushing's disease for fourteen months. The left kidney was displaced inferiorly.

Fig. 12. Case 10. Roentgenogram of the upper abdomen after retroperitoneal air insufflation in a 42-year-old female with Cushing's disease, demonstrating a left adrenal gland enlarged by an adenoma, $3 \times 2 \times 2$ cm. The right adrenal was small.

in differentiation from postmenopausal osteoporosis, which is known to have a predilection for the spine, pelvis, and to a less degree the extremities, while the skull is not significantly affected (4). Also, the age of the patient in postmenopausal osteoporosis is often quite different from that in the group with Cushing's disease, which usually occurs in relatively younger individuals. The "cotton-wool" appearance of the callus of fractured ribs is more common in Cushing's disease than in other conditions. In osteomalacia pseudo or true fractures do not produce much visible callus before the patient is treated medically. Partial or complete loss of lamina dura is not diagnostic of Cushing's disease or hyperparathyroidism. It may occur in severe osteoporosis of variant etiology or in osteomalacia.

Although not pathognomonic, unusual distribution of fatty tissues in the trunk with sparing of the extremities, cardiomegaly, premature vascular calcification, and adrenal enlargement should be considered as probable manifestations of Cushing's disease.

The establishment of the final diagnosis will depend on the clinical and radiographic findings plus blood and urinary chemical analyses.

SUMMARY

Roentgenographic findings of Cushing's disease as studied in 38 patients seen at the Massachusetts General Hospital since 1935 are presented. Various manifestations of osteoporosis involving the entire skeleton and soft-tissue changes of the major organs are evaluated. These are not specific for Cushing's disease, but in the light of clinical findings may suggest the correct diagnosis.

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SUMARIO

Enfermedad de Cushing: Sus Hallazgos Radiográficos

Preséntanse los hallazgos roentgenográficos en la enfermedad de Cushing según se estudiaran en 38 enfermos observados en el Hospital General de Massachusetts desde 1935. Las observaciones importantes, que parecen estar íntimamente relacionadas con la gravedad y la duración de la dolencia, se dividen en dos clases; alteraciones en los huesos y alteraciones en los tejidos blandos.

El proceso básico en los huesos es osteoporosis, manifiesta en particular en el cráneo, el raquis, las costillas, la pelvis y, en menor grado, los miembros, acompañándose de fracturas con sus complicaciones.

Entre las alteraciones del tejido blando, la observación roentgenológica más común es de hipertrofia del corazón asociada con hipertensión. El órgano que interviene primariamente en la producción de la enfermedad de Cushing es la glándula suprarrenal; su hipertrofia puede represen-

tar: (*a*) carcinoma, produciendo una tumefacción bastante grande de tejido blando con atrofia de la suprarrenal opuesta; (*b*) adenoma de menor tamaño; (*c*) hiperplasia bilateral, con muy leve aumento real del tamaño de las glándulas. Estos fenómenos pueden observarse con técnicas apropiadas, incluso la roentgenografía simple de la porción superior del abdomen, la laminagrafía, la aortografía abdominal y la insuflación retroperitoneal de aire; este último método, en particular cuando se combina con la urografía intravenosa, resulta a menudo ser el más informativo.

Aunque los hallazgos roentgenológicos no son específicos en la enfermedad de Cushing, a la luz de las observaciones clínicas, pueden sugerir el diagnóstico acertado. El establecimiento del diagnóstico definitivo se asentará en los datos clínicos y radiográficos más los análisis químicos de la sangre y la orina.

Roentgenographic Manifestations of Congenital Peripheral Arteriovenous Communications[1]

THOMAS O. MURPHY, M.D.,[2] and ALEXANDER R. MARGULIS, M.D.

SINCE THE INITIAL work of Hoyer (1), in 1887, and the subsequent investigations of Sucquet (2), Schumaker (3), and others, it has been well demonstrated that there are normal, as well as abnormal, arteriovenous communications in man and in the lower animals. Lewis (4) has shown these normal arteriovenous units, the "glomus bodies" of Masson (5), to be important in the heat-regulatory mechanisms of the body. However, the formation of the peripheral vascular system is not always perfect, and as a result we have the development of a multitude of types of vascular hamartomas, usually of a superficial nature. It is proposed that there are at least three types of congenital arteriovenous communications.

1. The glomus body, a normal physiological arteriovenous communication involved in the mechanism of body heat stabilization, under neuromuscular control.

2. The "central arteriovenous communication," in which major vessels of either the peripheral vascular bed or the pulmonary circuit are associated. These malformations develop early and probably represent a developmental arrest in the retiform stage of the vascular bed, as described by de Takats (6). This type of arteriovenous communication is large and produces symptoms of a systemic nature which are easily recognized.

3. The "peripheral" or maldeveloped type of glomus unit, as described by Popoff (7), lying in the inner zone of the stratum reticulare and stratum subcutaneum of the skin, is generally deeper than the normal glomus unit. The lumen is large, exceeding 0.1 mm. in diameter, and has little or no neuromuscular control. The potential cross-sectional area of this type of communication is large. Grant and Bland (8) have estimated it to be in excess of 1,209 sq. cm. in the hand, and even more in the foot and leg. An area of pigmentation of the skin may be associated with the distribution of this defect.

The diagnosis of central arteriovenous communications, as well as of communications arising on a traumatic basis, is not difficult. The blood flow *via* such shunts is large, and attention is early directed to them by the usual clinical signs. The third type of arteriovenous communication described above, the maldeveloped glomus unit, presents a much more difficult problem, and in our series of studies is much more common. It is this small type of peripheral arteriovenous communication that will be discussed in this report.

TECHNIC OF DEMONSTRATION

Attempts at radiographic demonstration of peripheral arteriovenous communications in the lower extremity were carried out on 8 patients in which such lesions were suspected. The bases for selection were as follows:

1. Abnormal phlebectasia of one extremity.
2. Abnormal skin temperature (elevation) of one extremity.
3. Elevation of the venous oxygen saturation from the femoral vein.
4. Shortened femoral artery-to-heart circulation time (9).

With the patient in a supine position on the x-ray table, a special cassette holder (Fig. 1) devised by Nelson and Watson (10) is placed under the extremity from the femoral area to the heel. The leg and foot are internally rotated to separate the

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projections of the tibia and fibula. Cassettes are placed in the film holder in such a fashion that the lateral half only of a 14 × 17-inch film is subject to exposure. A 17- or 18-gauge needle is inserted into the femoral artery under either local or general anesthesia. The x-ray tube is elevated to expose the lower extremity from the groin to the foot and placed in such a fashion that the "heel effect" gives maximum radiation to the thigh. This obviates the necessity of an exposure technic for the thigh and the leg separately.

Twenty to thirty cubic centimeters of 35 per cent iodopyracet (Diodrast)[3] are injected into the femoral artery in one to three seconds, and the first exposure is made just before the end of the injection. The cassettes are then pushed fully into the film holder, to allow exposure of the second half of the film, and as rapidly as possible, a second exposure is carried out.

In this fashion, both an early and a late phase of the arteriogram are recorded, and both the thigh and the leg may be investigated with one injection of the contrast agent.

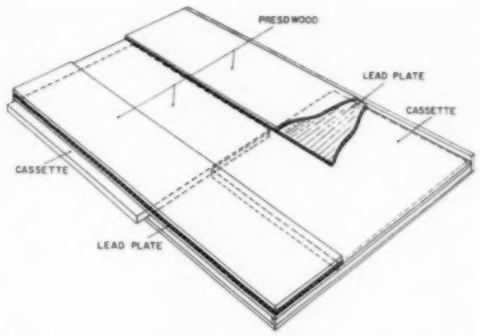

Fig. 1. Schematic drawing of the cassette holder for femoral angiogram.

ROENTGEN APPEARANCE

A normal arteriographic study of an extremity presents two phases: an arterial phase, during which the major arteries are filled and simultaneously opacified and a capillary phase as they are emptied of contrast agent. During this second phase, there is a diffuse opacification of the soft tissues. A third or venous phase, as discussed by Piulachs and Vidal-Barraquer (11), is largely theoretical. Normally the contrast material diffuses so widely throughout the extremity that the amount injected is insufficient to delineate the major trunks.

A normal arteriogram without any evidence of arteriovenous communication is virtually non-existent. As noted above, small and infrequent arteriovenous communications are present in all extremities, and the pathologic status is merely a matter of degree. Many individuals have large abnormal arteriovenous communications which do not cause significant symptoms and escape detection unless studies are carried out for other reasons.

In the classic article on arteriography by Allen and Camp (12), describing two patients with arteriovenous malformations of the hand, three criteria were outlined: dilatation of the arteries leading into the fistula; absence of arterial demonstration distal to the fistula; pooling of the contrast agent in the area of the fistula. In a review of the findings in our 8 cases, all of which had extensive involvement of the lower extremity, dilatation of the arteries leading into the involved area was noted, but distal arteries, were visualized and there was no pooling of the contrast medium. On the contrary, its transport was more rapid than normal.

On the basis of our study, and after correlation of the roentgen signs with the surgical findings, we feel that there are several primary diagnostic features which are characteristic of arteriovenous communications. Secondly, there are signs which are not only characteristic but also indicate advanced and massive involvement of the extremity. A third group of signs are present in the normal examination and only by their multiplicity and prominence assume clinical significance. Still another group of findings are associated with congenital arteriovenous communications and are the result of their presence

[3] Winthrop Laboratories.

Fig. 2. Arteriogram of a 2-year-old child showing contrast medium in both the major arteries (A) and the deep veins (B). There are areas of venous rete just above the knee (C) and the ankle (D). Superficial veins (E) are filled simultaneously.

but are not specific, being found also in other conditions.

1. *Primary Diagnostic Signs of Congenital Arteriovenous Communications:* (*a*) The venous rete, a small or large plexiform formation of distended arterialized veins, is usually seen around the ankle but may be visualized elsewhere (Figs. 2 and 4). These veins are filled concurrently with the large arteries and are noted only in the presence of arteriovenous communications. At operation these veins can be identified; they pulsate and, when sectioned, yield arterial blood. Piulachs (10) has demonstrated this finding in his studies on similar lesions. Venous retia were well demonstrated in 7 of our 8 patients (Figs. 2–4).

(*b*) Demonstration of superficial veins filled with contrast medium simultaneously with filling of the large arteries is also diagnostic of arteriovenous communication (Figs. 2, 3, and 5).

2. *Diagnostic Signs Occurring in Advanced and Massive Involvement:* As pointed out above, the arteriovenous communications under consideration here are small, but multiple. If there is massive and extensive involvement, the flow *via*

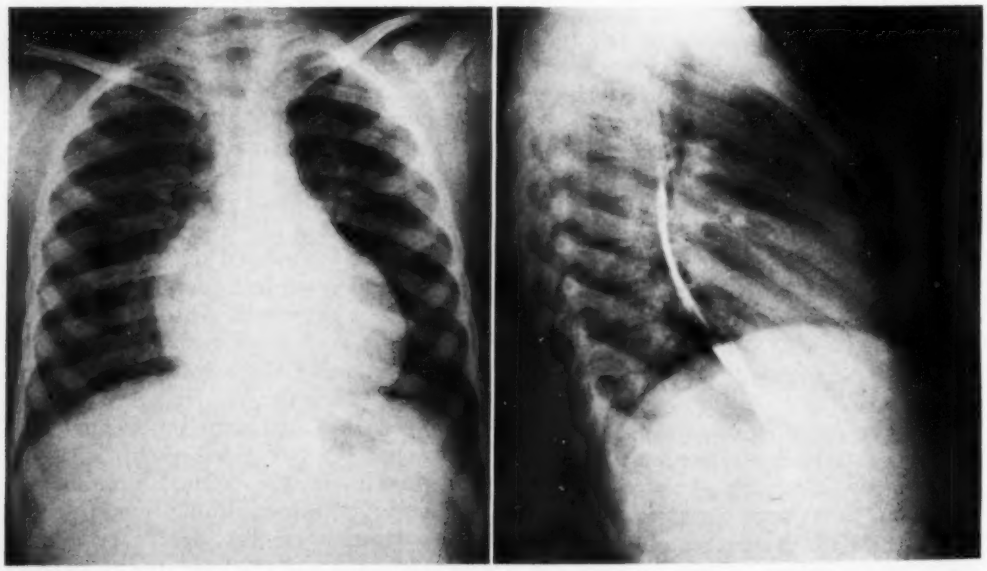

Fig. 2A. Same case as Fig. 2. The very large heart and prominent pulmonary vessels are consistent with a large left-to-right shunt. Interventricular septal defect or patent ductus arteriosus was suspected but excluded by cardiac catheterization.

the shunts is increased. In these instances, filling of the deep venous system occurs simultaneously with filling of the major arteries. In one of our patients, the flow through many of these small communications was enough to produce systemic effects as demonstrated by cardiac

Fig. 3. Early and late arteriogram showing venous rete (A) at the ankle and abnormal segmentation from the major arteries (B). The saphenous veins (C) are filled from the venous rete at the ankle.

enlargement and increased pulmonary vascularity (Fig. 2A).

3. *Signs of Isolated Arteriovenous Communications That Are Significant by Their Multiplicity and Prominence:* (*a*) Branches arising from the parent artery in a regular and periodic pattern are designated by the term "segmentation." Normally segmentation of small branches from the main arterial stem of the superficial femoral artery above the origin of the supreme geniculate artery is not usually observed, and the same is true of the smaller arteries of the leg. Occasionally small segmental branches are present in the early arteriosclerotic extremity as collaterals (Fig. 6), but these are not prominent and do not

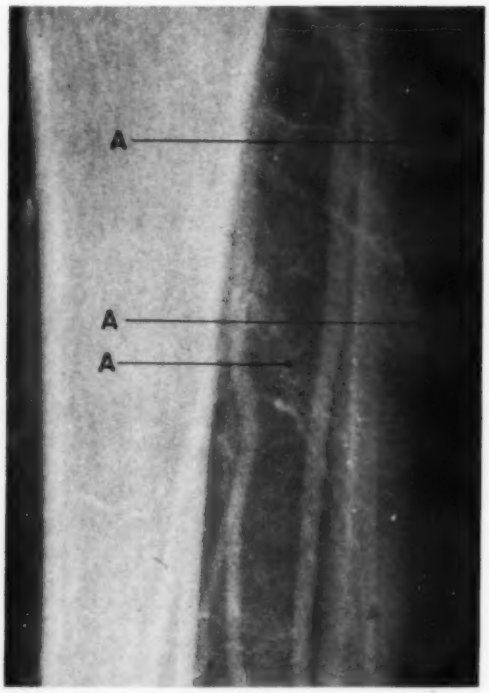

Fig. 4. Femoral arteriogram: enlargement of an area of several localized retia (A) in juxtaposition to a superficial vein.

persist through the late phase of the arteriogram. In patients with arteriovenous communications, however, such vessels come off regularly at short intervals, are prominent, numerous, and persistent. The greater the involvement, the more pronounced are these findings (Fig. 5). These vessels are visualized as a result of the arterial dilatation of normally placed channels which carry unusually large amounts of blood to the superficial arteriovenous communications.

(*b*) In all of our studies we have encountered with variable frequency, vessels parallel to a deep artery, and connected with it by a horizontal vessel in an "H" formation. The horizontal vessel is perpendicular to a superficial parallel vessel and enters somewhat in the middle of the area visualized, so that filling is both proximal and distal. We believe that the "H" formation thus produced is a demonstration of the communication itself.

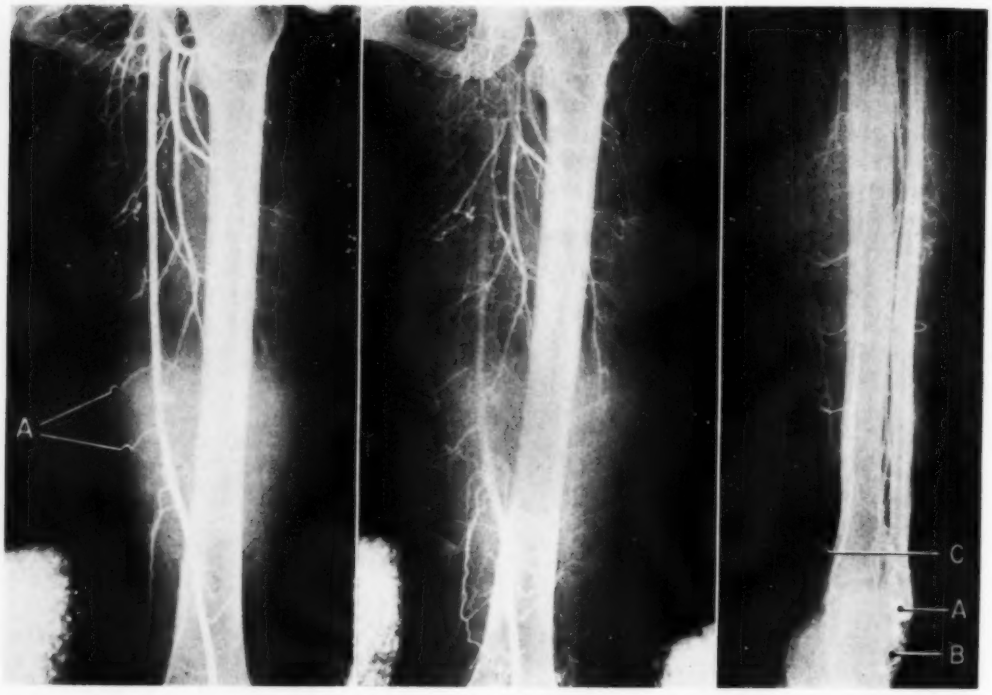

Fig. 5. An early and late arteriogram of the thigh showing abnormal segmentation of the main stem arteries (A). Arteriogram of the leg showing abnormal segmentation with filling of the lesser saphenous vein (A), venous rete at the ankle (B), and filling of the saphenous vein (C) with contrast medium.

Fig. 6. Early and late arteriogram of a patient with early arteriosclerosis. Occasional segmental vessels (A) are noted from the main stem as collaterals.

Some asymptomatic individuals may have a few such formations (Fig. 7) but they do not occur with the frequency seen in the condition under discussion (Figs. 2 and 5). Surgical dissections have confirmed this view.

(*c*) Non-tapering of the peripheral branches: In the presence of arteriovenous communications, the peripheral small branches are dilated by the increased flow *via* the shunt and do not narrow down or taper. The same condition may be noted in the collateral vessels in occlusive arterial disease, but there it is associated with marked tortuosity and usually with evidence of an irregular contour of the lumen of the main arterial stem (Fig. 8).

4. *Non-specific Associated Changes with Arteriovenous Communications:* (*a*) As noted in many studies, the size of the extremity is increased. This feature, however, may be associated with other conditions, such as neurofibromatosis and lymphangioma.

(*b*) An irregular soft-tissue contour may sometimes be noted (Fig. 5), due to the

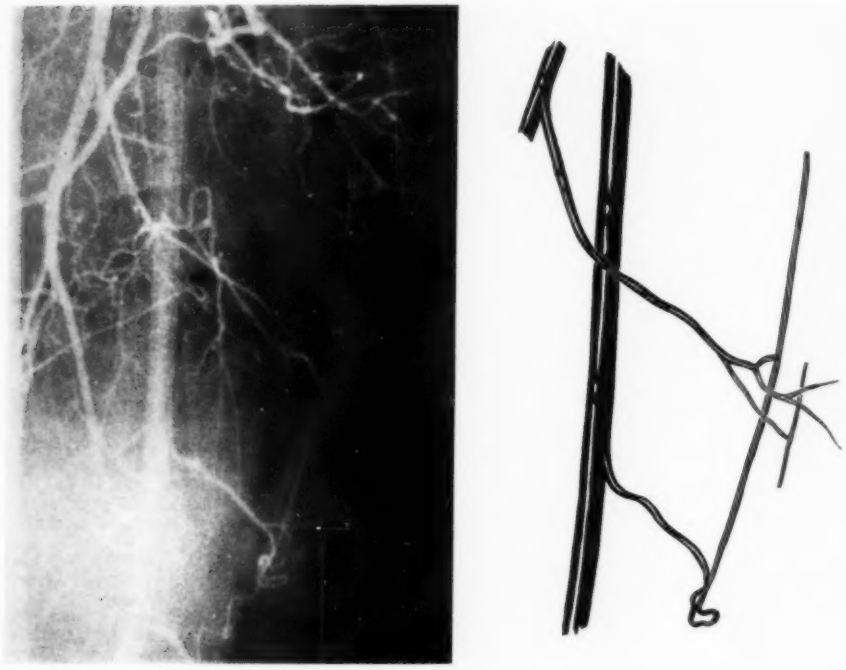

Fig. 7. Typical "H" formation.

increased size of the extremity or to large superficial venous channels draining it.

In summary, the roentgen findings in the present series of 8 patients were as follows:

Deep venous channels	1
Superficial venous channels	7
Venous rete	7
"H" formations	8
Prominent segmentation	6
Non-tapering of peripheral vessels	8
Increase in size of extremity	7
Irregular soft-tissue outline	6
Cardiac enlargement	2

DISCUSSION

The diagnosis and demonstration of small congenital arteriovenous communications are difficult. The clinical signs are obscure and the laboratory procedures exacting and complex. Unless there is massive involvement, the radiographic demonstration of these lesions often consists simply in an increased prominence and multiplicity of findings normally observed. In the case shown in Figure 2 the communications were very numerous, extending from the hip to the foot. There were marked changes in the arteriogram, with early opacification of the deep venous channels, as well as the signs mentioned above. The heart was greatly enlarged, and of a configuration consistent with a large left-to-right shunt such as is found in ventricular septal defect and patent ductus arteriosus. Figures 3 and 5 show extensive involvement, with filling of the superficial veins concurrently with the major arteries and venous retia around the ankle. Clinically, these patients have tremendous greater saphenous veins and large extremities. In the case shown in Figure 3 there was less involvement but with prominent segmentation from the major arteries and a venous rete visualized at the ankle. Thus, in all these studies, the deviation from the normal is one of degree. The clinical signs and symptoms are also of varied degree, ranging from cardiac manifestations in one instance to unilateral large varicose veins in the studies with lesser involvement.

Fig. 8. Arteriosclerotic occlusive disease of the superficial femoral artery. Note the non-tapering tortuous collateral vessels. The large vessels show irregularities of the lumen.

SUMMARY

The roentgen manifestations of 8 proved cases of congenital arteriovenous communications have been discussed. It is noted that there are characteristic features, as follows:

1. Signs which are diagnostic.
2. Signs which are indicative of extensive involvement.
3. Signs which are significant only with multiplicity and prominence.
4. Associated signs which are the result of the arteriovenous communication, but are also found in other conditions.

It is suggested that these lesions are more frequent than is generally realized.

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SUMARIO

Las Manifestaciones Radiográficas de la Comunicación Arteriovenosa Periférica Congénita

El diagnóstico de la existencia de comunicaciones arteriovenosas centrales y de comunicaciones anteriovenosas surgidas a base traumática no es difícil. La tercera forma, a saber, la "periférica" o vicio de desarrollo del glomo como unidad, plantea un problema diagnóstico más difícil. Preséntase aquí una serie de 8 casos de esta última lesión, discutiéndose sus características roentgenológicas. Estas se agrupan en cuatro clases:

(1) Signos que son diagnósticos: (*a*)

observación de una red venosa, formación plexiforme pequeña o grande de venas arterializadas distendidas, por lo general cerca del tobillo, que se llenan junto con las grandes arterias; (*b*) henchimiento de contraste de las venas superficiales simultáneamente con el henchimiento de las arterias grandes.

(2) Signos indicativos de invasión extensa: (*a*) henchimiento del sistema venoso profundo simultáneo con el henchimiento de las arterias principales.

(3) Signos que no revisten importancia más que por su multiplicidad y descuello: (*a*) segmentación, es decir, patrón regular y periódico de ramas procedentes de las arterias más pequeñas; (*b*) formación en "H" producida por vasos paralelos a una arteria profunda, unidos por un vaso horizontal; (*c*) falta de ahusamiento de las pequeñas ramas periféricas.

(4) Alteraciones anespecíficas: (*a*) aumento de tamaño del miembro; (*b*) contorno irregular del tejido blando.

The Diagnostic Importance of Normal Variants in Deep Cerebral Phlebography

With Special Emphasis on the True and False "Venous Angles of the Brain" and Evaluation of Venous Angle Measurements[1]

JOHN F. MOKROHISKY, M.D.,[2] ROBERT E. PAUL, M.D., PAUL M. LIN, M.D., and HERBERT M. STAUFFER, M.D.

THE VALUE OF THE deep cerebral veins in cerebral angiography, as an aid in localizing space-taking intracranial lesions, has been well established by a number of investigators. Particular attention has been directed to localization of the foramen of Monro through visualization of a characteristic vein coursing through it. This vein, formed by the junction of the striothalamic (terminal) with the internal cerebral vein, forms a smooth, sharp curve as it courses around the posterior margin of the foramen. The point at which the two veins join has been called by Krayenbuhl and Richter the "venous angle of the brain" (V-A) (Fig. 1).

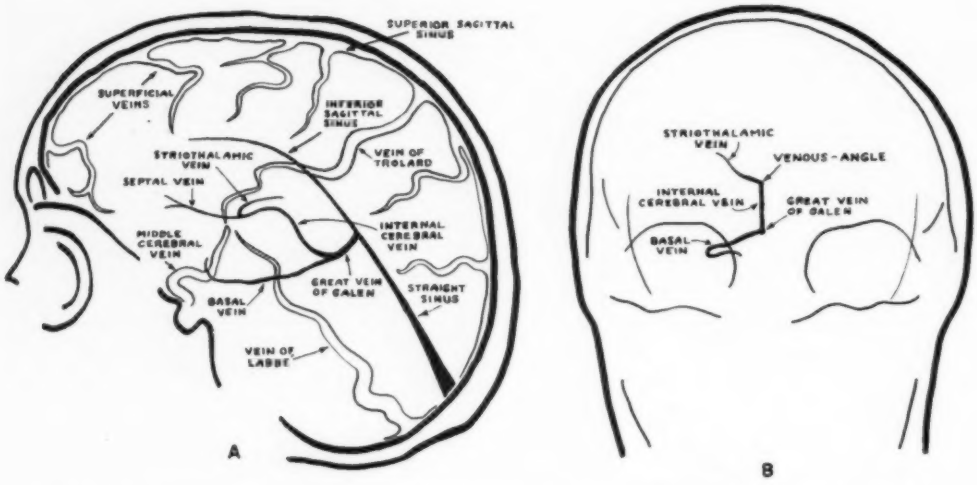

Fig. 1. A. Schematic drawing showing the dural sinuses, and deep and superficial veins. Lateral view. B. Schematic drawing showing the relationship of the deep cerebral veins. Anteroposterior view.

The deep cerebral veins have a fairly constant course and configuration. Exceptions are not unusual, however, and should be distinguished from pathologic changes. It is the purpose of this paper to show the normal variations of the deep veins and sinuses and various types of tributaries of the internal cerebral vein which result in a false "venous angle of the brain," and to discuss the significance of charts used in localizing the foramen of Monro through visualization of the true "venous angle."

APPARATUS AND TECHNIC

This study is based on a series of 400 cerebral angiograms (normal and abnormal) obtained with the Chamberlain bi-

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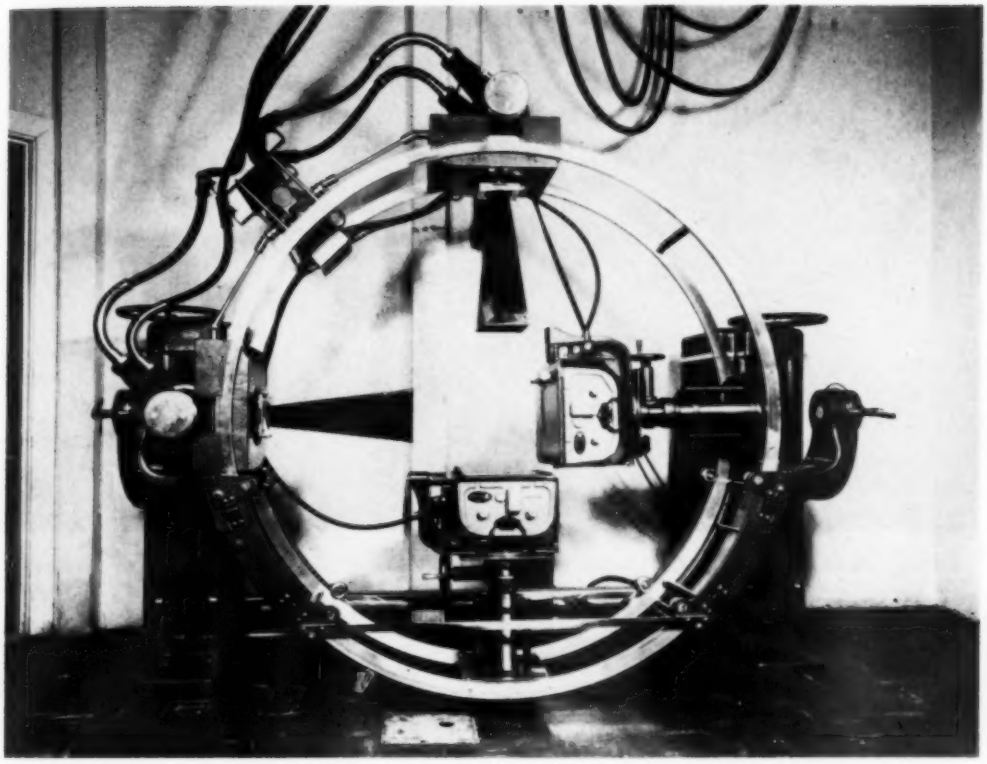

Fig. 2. The Chamberlain biplane, stereoscopic, rapid-sequence angiographic unit.

plane, stereoscopic, rapid-sequence angiographic unit (Fig. 2). The mechanical features include two Fairchild roll-film magazines at right angles to each other, mounted in a circular frame 6 feet in diameter, with two rotating anode roentgen tubes mounted opposite the magazines, each with a crank mechanism for stereoscopic shift. Crisscross stationary grids (Schönander) in front of each magazine effectively control scatter from both tubes firing simultaneously. The frame travels on rollers permitting rotation through 180 degrees. Both tubes shift between exposures and during the film transport, so that in each projection each exposure on the roll is stereoscopic with both the one preceding it and the one following it. The time lapse between exposures is 0.6 second. The average target-film distance is 40 inches. Successive sequences may be spaced as desired for each particular examination, or the length of exposure may be longer if so desired.

Twelve exposures are made for a cerebral angiographic study in both the anteroposterior and lateral projections, the first being obtained before the start of injection. The contrast material is injected into the carotid artery as rapidly as possible through an 18-gauge needle. The cerebral phlebogram is visualized on the last four or five stereoscopic pairs of films.

Some of the advantages of this unit include: (1) simultaneous exposures in two planes at right angles to each other; (2) a rapid sequence of exposures, permitting visualization of all phases of the cerebral circulation and giving some indication as to the rate of cerebral flow; (3) stereoscopic films, aiding in determination of the depth and position of vessels; (4) the ability to perform the study with a single injection of contrast material. A single

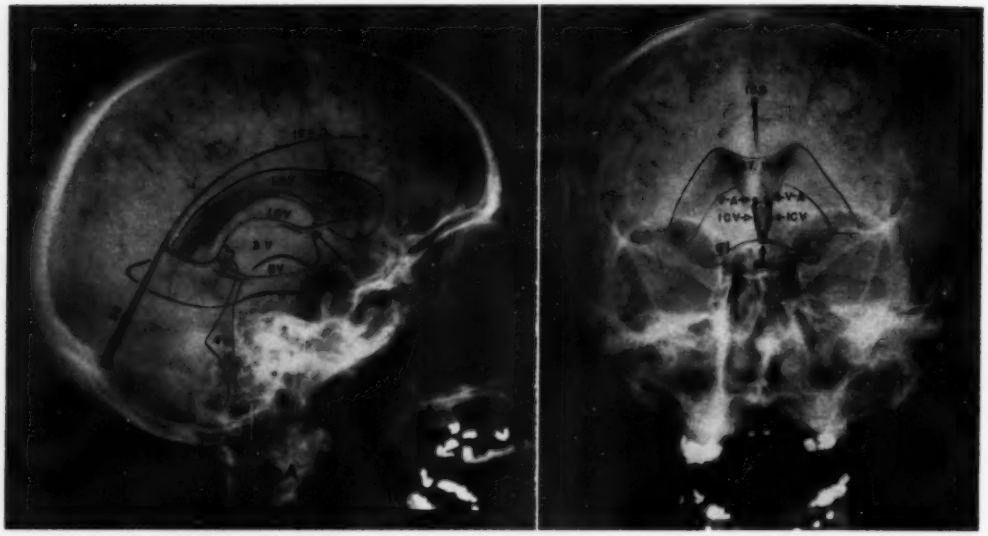

Fig. 3. Topographic relationship of the deep cerebral veins to the ventricular system. ISS. Inferior sagittal sinus. SS. Straight sinus. GV. Great vein of Galen. ICV. Internal cerebral vein. STV. Striothalamic vein. SV. Septal vein. V-A. "Venous angle." BV. Basal vein of Rosenthal.

percutaneous injection of 10 c.c. of 30 per cent Urokon Sodium was found adequate for visualization of the arterial, capillary, and venous phases.

The "normal" angiograms in this study were obtained on patients with normal or insignificant neurological findings, normal electroencephalograms, and normal cerebral spinal fluid studies. Normality in some of these patients was verified by pneumoencephalography. Patients with histories of old spontaneous subarachnoid hemorrhage with or without demonstrable aneurysms were also included in this series of "normals," provided at the time of examination there was no evidence of fresh hemorrhage or hematoma formation.

NORMAL ANATOMY

The foramen of Monro is a constant intracranial landmark, the posterior border of which is outlined by the junction of the striothalamic and internal cerebral veins. The striothalamic vein runs along the lateral inferior wall of the lateral ventricle in a groove between the caudate nucleus and the thalamus. As seen in the lateral view, as it approaches the foramen of Monro, it forms a smooth curve with its convexity forward, and joins the internal cerebral vein along the postero-inferior margin of this foramen to form the "venous angle of the brain." Along its course it receives branches from the thalamus, corpus striatum, and internal capsule. Usually the septal and choroidal veins join the striothalamic vein at the origin of the internal cerebral vein.

The internal cerebral vein, which originates at the site of the foramen of Monro, courses upward and backward for a distance equal to approximately half its length and then dips downward and backward to join its mate of the opposite side to form the great vein of Galen, which in turn empties into the straight sinus. The combined internal cerebral vein and great vein of Galen form a characteristic curve similar to a sine wave.

The basal vein of Rosenthal, situated a short distance from the mid-line, begins in the region of the anterior perforated substance. It courses backward a few centimeters from its origin and then upward, backward, and medially, around the cerebral peduncles in the cisterna ambiens to

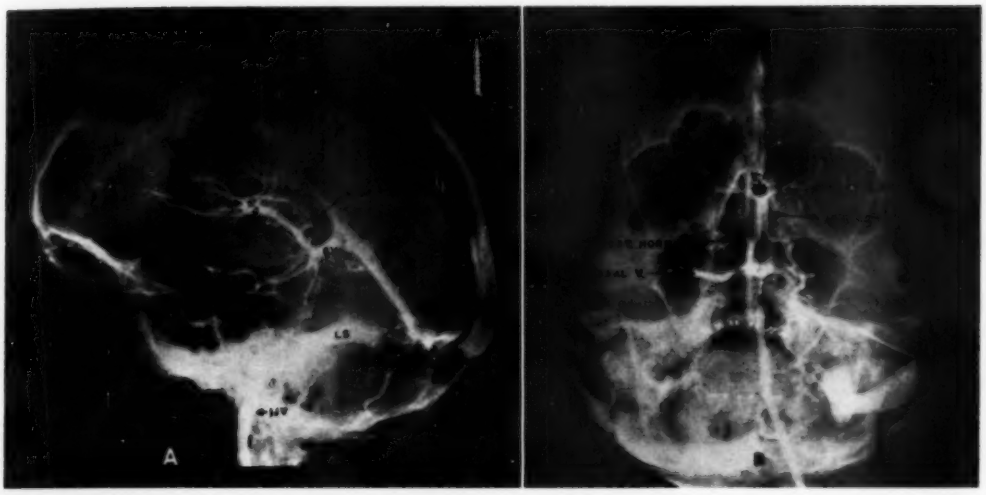

Fig. 4. Autopsy specimen: Lateral (A) and Waters (B) views. SV. Septal vein. V-A. "Venous angle." STV. Striothalamic vein. ICV. Internal cerebral vein. GV. Great vein of Galen. BV. Basal vein of Rosenthal. ISS. Inferior sagittal sinus. SS. Straight sinus. SSS. Superior sagittal sinus. LS. Lateral sinus. IJV. Internal jugular vein. The long arrows on the lateral view point to a false "venous angle" and the vein of the posterior horn. Reproduced, by permission, from Lin, Mokrohisky, Stauffer, and Scott: J. Neurosurg. **12**: 256–277, May 1955.

open into the great vein of Galen. In the lateral view, the anterior portion of the basal vein is situated about 1 cm. above the sella turcica. In the anteroposterior view, it has a characteristic curve, convex laterally.

The topographic relation of the veins to the ventricular system is shown in Figure 3.

FALSE "VENOUS ANGLE OF THE BRAIN" (*Fig. 4*)

We have found visualization of venous tributaries of the internal cerebral vein on the phlebogram to be a source of difficulty in localizing the foramen of Monro in a significant percentage of cases. This usually occurred when the main venous drainage from the thalamus, corpus striatum, and internal capsule was through a tributary vein behind the foramen of Monro rather than through the usual striothalamic or terminal vein.

Venous tributaries may enter the internal cerebral vein anywhere along its course. Opening into the posterior third is a constant vein running along the medial wall of the posterior horn (Fig. 4). Tributaries continuous with the caudate veins may result in false localization of the foramen of Monro. This is true when the striothalamic and anterior portion of the internal cerebral vein are not filled with contrast material. Tributaries to the internal cerebral, excluding the vein from the posterior horn (Johanson), were found in 20 per cent of the 400 cases reviewed. These tributaries opened into the vein in its anterior third or middle third, or at the junction of the two, and assumed a course similar to the striothalamic vein. In more than half of these cases (60 per cent) the tributary was greater in caliber than the striothalamic vein, and the latter was absent or so faintly visualized on most of the serial phlebograms that exact localization of the foramen of Monro was not always possible. Since rapid-sequence films were obtained in each case, we occasionally found both the tributary and the striothalamic veins filled at the same time, but most of the phlebograms in a given case showed only the tributary. We eventually learned to recognize these tributaries regardless of filling or non-filling of the striothalamic vein.

The various types of tributaries of the internal cerebral vein that we have encountered are shown as tracings in Figure

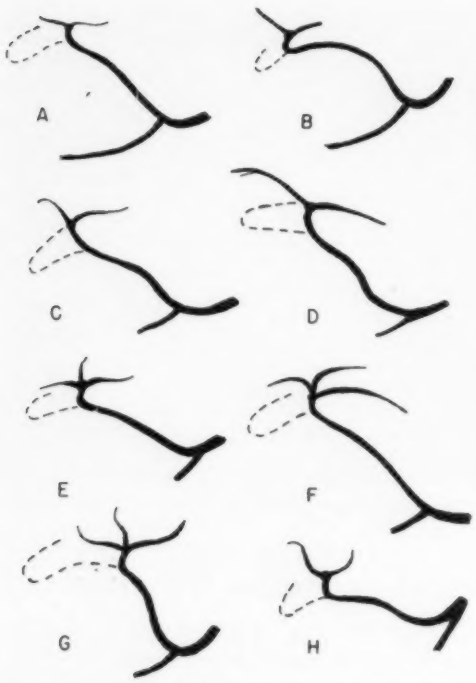

Fig. 5. Diagram showing various types of false "venous angles." The true "venous angle" (junction of the striothalamic with the internal cerebral vein), represented by the broken lines, may not be opacified by contrast material.

5. The most common variation is represented by a tributary opening into the anterior third of the vein, or at the junction of the anterior and middle thirds (Fig. 6). This tributary is continuous with the caudate veins, and together they simulate the striothalamic vein, the tributary, and one of the posteriorly directed caudate veins forming a curve similar in appearance to a striothalamic vein. In these cases the foramen of Monro may be erroneously localized posteriorly, or upward and posteriorly. The absence of the anterior third of the internal cerebral vein, in these cases, gives the appearance of straightening of this vein. The false angle or loop may also suggest widening.

The following are a few important points in recognizing this false "venous angle of the brain": (1) The tributary opens into the internal cerebral vein at its most cephalad position, so that the most anterior ascending portion of the latter vein is absent. (2) The tributary may show a gradual slope directed downward and backward and lack the smooth curve of the striothalamic vein. (3) The tributary at its junction with the caudate veins is represented by a dense dot where other caudate veins enter, so that it lacks the smooth uninterrupted course of the striothalamic vein. (4) The tributary may enter the internal cerebral vein at right angles.

When the tributary opens into the middle third of the internal cerebral vein it has the same features as one situated more anteriorly. When the opening is into the posterior third of the internal cerebral vein, the tributary has no constant course and its entry into the internal cerebral vein along the downward slope is so posterior that there is no problem of confusion with a posteriorly displaced venous angle.

Identification of the venous angle through visualization of the junction of the septal and internal cerebral veins is accurate in most cases. However, there do occur variants where the septal vein opens into the internal cerebral vein behind the foramen of Monro (Fig. 7). If the striothalamic vein is not filled with contrast material, the junction of the septal with the internal cerebral vein may be difficult to locate because of a smooth continuity between these vessels, with a lack of change in caliber at their junction. The superior choroidal vein of the lateral ventricle, if visualized, is helpful in localization of the venous angle, since it usually opens directly into the internal cerebral or striothalamic vein in the region of the foramen of Monro. It is rarely seen, however, in internal carotid angiography, although often visualized in vertebral angiography.

OTHER VARIATIONS OF THE DEEP VEINS AND DURAL SINUSES

Variations in the configuration of the venous angle are shown in Figures 8 and 9. The venous angle as seen on the lateral phlebogram may normally be represented by a sharp acute angle, by a wide angle, or by a narrow, smooth angle close to the in-

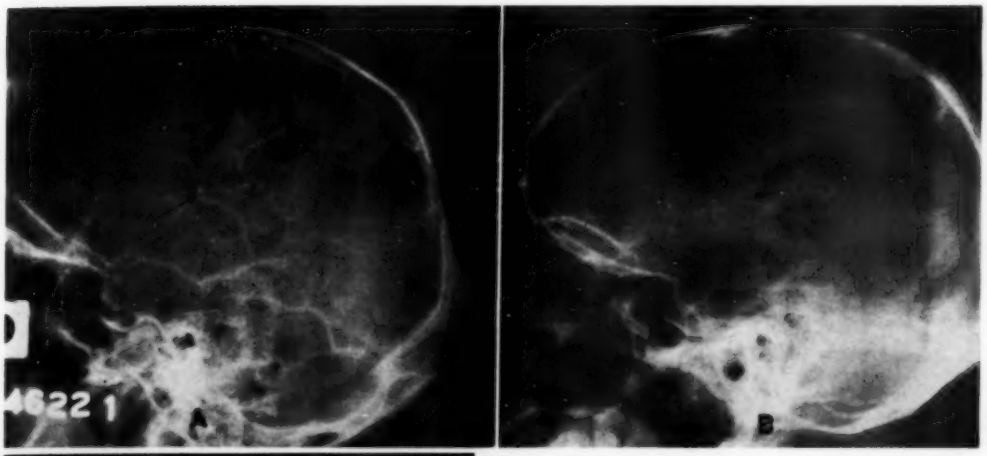

Fig. 6. A. The arrow points to a false "venous angle" formed by a tributary opening into the internal cerebral vein at the junction of its anterior and middle thirds. The anterior part of the internal cerebral vein and the striothalamic vein are not opacified.

B. The arrow points to a tributary (F V-A) entering the middle third of the internal cerebral vein. This film, of the rapid-sequence set, failed to show the true "venous angle."

C. Film, from the same sequence set, showing faint opacification of the true "venous angle" (short arrows) conclusively identified by stereoscopy. The long arrow points to the false "venous angle" (F V-A), which if not recognized as such may be mistaken as indicating a displaced foramen of Monro.

ternal cerebral vein. These normal variants may simulate changes seen in deep central tumors.

The course of the internal cerebral vein along the roof of the third ventricle also presents normal variations, as shown in Figure 10. This vein may show a rather prominent upward convexity such as occurs with a frontal lobe tumor. This type of configuration is shown in Figure 10A. Normality, in this case, was confirmed by pneumoencephalography (Fig. 10B). The vein normally may appear flattened, as though displaced downward by a tumor superior to it. All of these normal variations are important in that they may be interpreted as representing a pathological condition.

The septal vein, which arises from the anterior and medial part of the anterior horn and passes backward along the sep-

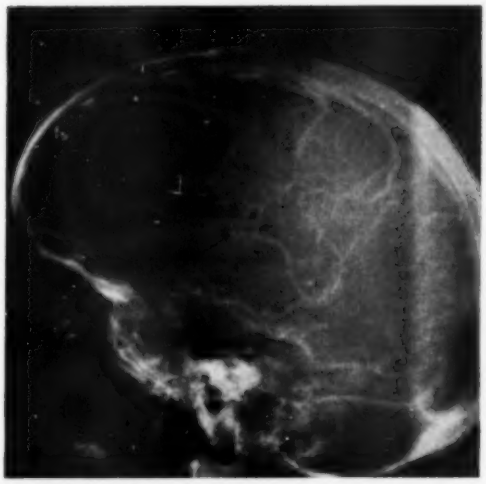

Fig. 7. Variation of the septal vein (short arrows). The long arrow points to the "venous angle," the usual site of termination of the septal vein.

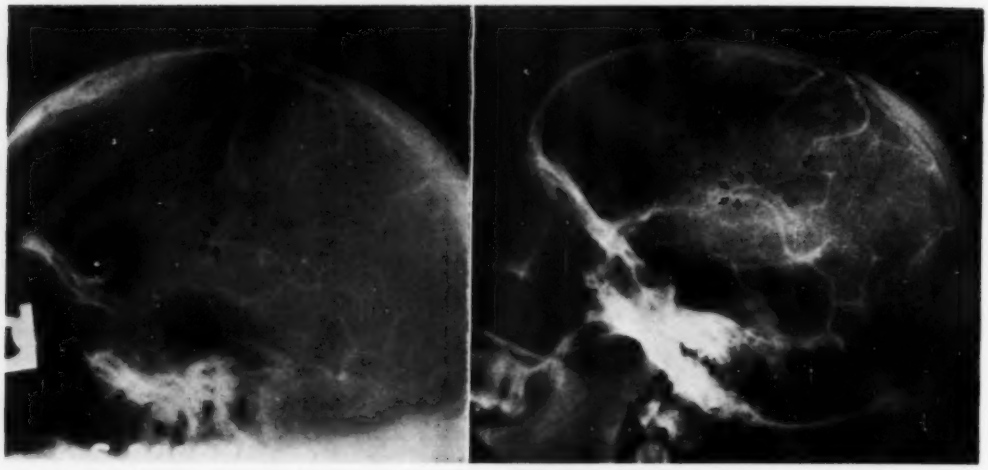

Fig. 8. A. Normal variation of "venous angle." A sharp angle is formed at the junction of the striothalamic with the internal cerebral vein.
B. Normal variation of "venous angle." The "venous angle" is represented by a shallow, smooth curve.

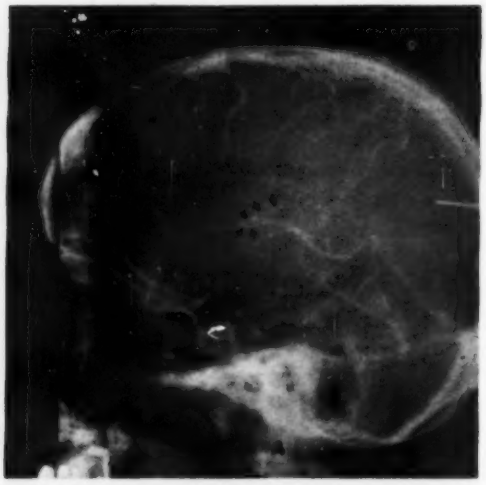

Fig. 9. Normal variation of "venous angle." The angle is narrow and practically closed, simulating changes seen with an anterior corpus callosum tumor.

tum pellucidum, is usually slightly curved, although it may be quite straight. At times two septal veins may be present on the same side, or the vein may be bifid in appearance. As mentioned previously, there may or may not be a change in caliber at its junction with the internal cerebral vein, and it may open into the internal cerebral vein behind the foramen of Monro (Fig. 7).

The curve of the great vein of Galen is generally regarded as defining the splenium of the corpus callosum. When this is the case, the vein opens into the straight sinus, forming an acute angle with it. The great vein of Galen does not always have this constant course. When it opens into the straight sinus at a right angle or an obtuse angle, it can be separated from the splenium to a varying degree. The splenium is more accurately defined by the posterior cerebral vein, which closely follows its curve to open into the internal cerebral vein (Fig. 11).

The inferior sagittal sinus generally forms a smooth curve with an upward convexity as it runs along the lower border of the falx. A large number of normal variations occur in the configuration and course of this sinus. In certain cases it has a more or less straight course. The distance between the inferior sagittal sinus and the inner table of the vertex also varies considerably.

The straight sinus, which runs along the mid-line of the tentorium, may join the inferior sagittal sinus in an uninterrupted smooth curve or may show a slight change in direction at the site of junction. It enters the torcular Herophili with varying degrees of obliquity. Its course may be

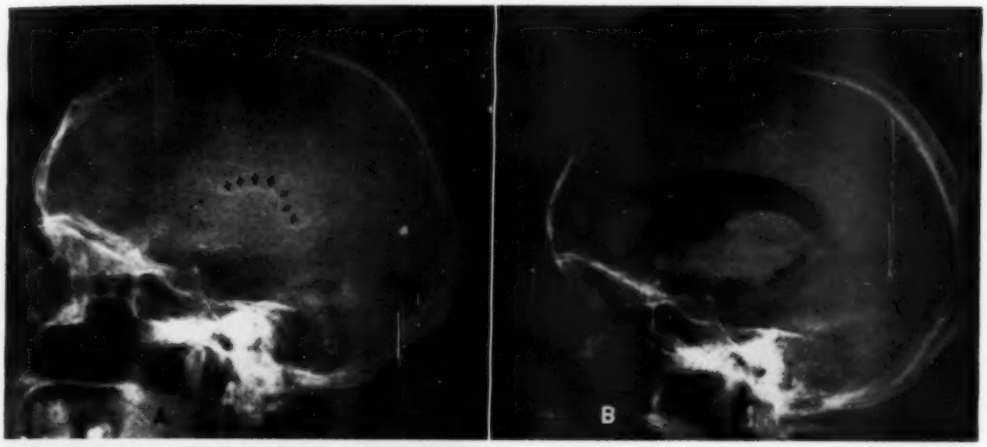

Fig. 10. A. Normal variation of internal cerebral vein. The vein appears compressed in the anteroposterior direction. This type of bowing simulates changes seen with a frontal lobe tumor.

B. The pneumoencephalographic study in this case was normal.

C. Normal variation of internal cerebral vein. The vein appears flattened.

straight, convex upward, or convex downward (Fig. 12).

The basal vein of Rosenthal may have a wavy or straight course when viewed on the lateral phlebogram. In the anteroposterior view it may be fairly straight or show a convex curve laterally. It may open into the posterior part of the internal cerebral vein at any point along the great vein of Galen, or directly into the straight sinus (Fig. 13). The posterior part of the basal vein may assume a knee-bend configuration when it opens into the posterior part of the internal cerebral vein or into the anterior part of the great vein of Galen. It forms a gentle curve along its posterior course when it opens into the posterior portion of the great vein of Galen or into the straight sinus.

MEASUREMENTS OF THE "VENOUS ANGLE OF THE BRAIN"

Since the foramen of Monro is a constant landmark situated in a vulnerable location for displacement in any direction, an objective method of measuring it would appear to be of real value. The first authors

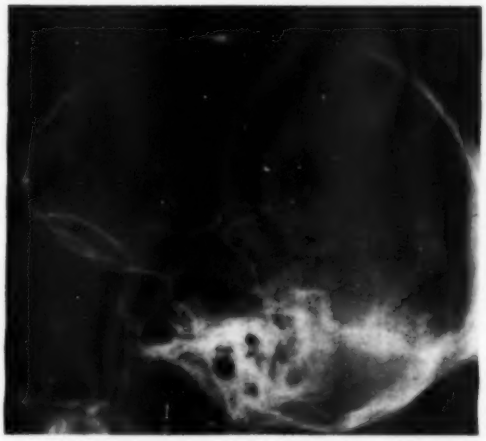

Fig. 11. Normal variation of the great vein of Galen. An obtuse angle is formed by the junction of this vein with the straight sinus (short arrows). The great vein of Galen does not always define the splenium of the corpus callosum. The splenium is more accurately outlined by the posterior cerebral vein (long arrows).

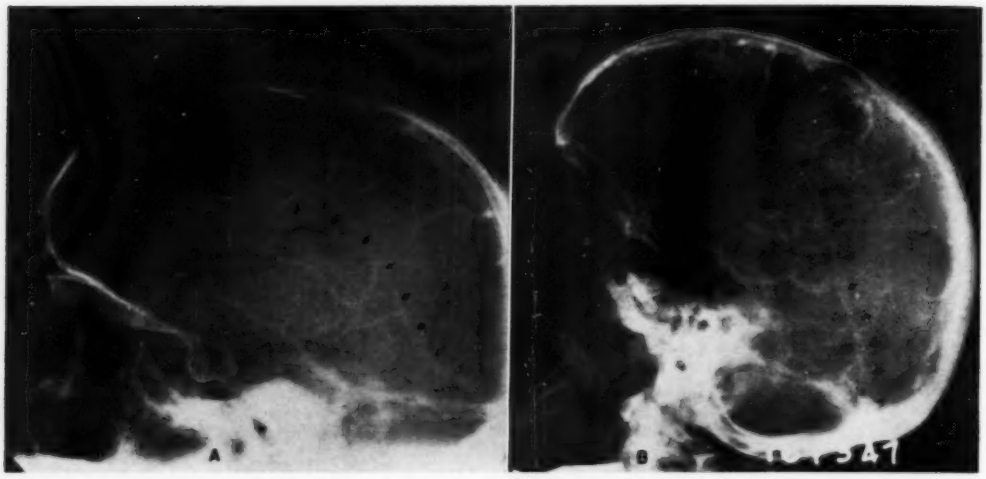

Fig. 12. A. Normal variations of the inferior sagittal and straight sinuses. The straight sinus is convex downward.
B. Normal variations of the inferior sagittal and straight sinuses. The straight sinus is slightly convex upward.

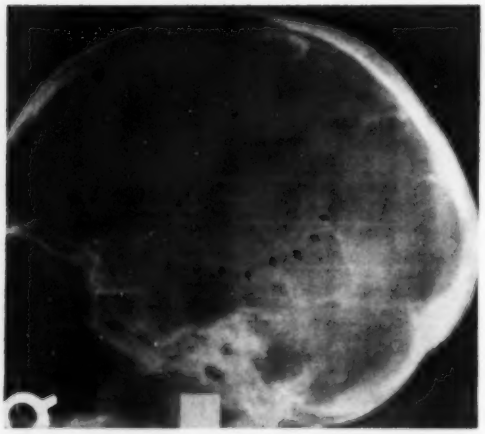

Fig. 13. Normal variation of basal vein (short arrows). The vein opens directly into the straight sinus. "Venous angle" (long arrow).

to mention a method of measurement were Curry and Culbreth (1951), who stated that, "the distance from the anterior convexity of the internal cerebral vein to the posterior clinoid process ranges from 3.4 to 4.0 cm." Umbach, in 1952, used a squared net with 3 × 3-cm. meshes to determine the position of the internal cerebral vein on lateral angiograms. Johanson, in 1954, found the venous angle to lie within a circle 15 mm. in diameter in 80 per cent of normal cases. He indicated that a venous angle falling outside a 22-mm. circle was probably the result of a pathological process, since the chance of a normal variant out of this range was 1 in 370. Johanson used a co-ordinate system to measure the venous angle from two constant lines, one drawn from the endobregma to the tuberculum sellae and another at right angles to the first. He also measured the point lying farthest basally on the posterior, downward, convex curve of the internal cerebral vein. He did not use the height and length of the cranium in orientation of the venous angle, since he found that no covariation existed between the coordinates for the points measured and the height and length of the cranium. This has not proved to be true in our experience and, after experimenting with various methods of measurement, we found it possible to establish a narrower range of normal variation when the length and height of the cranium were used in measuring the venous angle.

Recently, Wolf *et al*, published a template for localizing the most anterior point, the mid-point, and the lowest point of the internal cerebral vein. This template was devised on a trial-and-error basis after

measurements were taken on 24 "normal" phlebograms. The base line used by these workers was a line drawn from the tuberculum sellae to the lower margin of the sulcus for the transverse sinus. They stated that the most anterior point of the internal cerebral vein should not be more than 2.5 mm. posterior to a line originating 13 mm. behind the tuberculum sellae and extending upward at right angles to the base line. No reliance was placed on anterior displacement. To detect displacement in a cephalocaudal direction, the anterior point of the internal cerebral vein was orientated on a constant ratio scale with the endovertex, and on the same vertical line running at right angles to the base line. Similar constant ratio scales were used by these authors for orientation of the mid-point and lowest point of the internal cerebral vein in a cephalocaudal direction on lines running from the tuberculum sellae to the endovertex, without utilizing the base line. They indicated that when the anterior point of the internal cerebral vein (venous angle) was 3 mm. posterior to the vertical line a pathological condition was to be suspected. Utilizing the template, however, we found too many of our normal cases (20.5 per cent) falling outside of the limits as described by these workers.

During the past year we have used a chart devised by one of us (P. M. L.) for orientation of the venous angle. This chart (Fig. 14) is similar to the pineal chart constructed by Vastine and Kinney. We have determined the normal range of variation of the position of the venous angle in the cephalocaudal direction and in the ventrodorsal direction, and have compared these measurements with Johanson's chart and the template devised by Wolf *et al.*

The venous angle is orientated in the following manner (Fig. 15).

A. Select the anterior convexity point along the venous angle, *A*. This is the point at which the striothalamic vein joins the internal cerebral vein. The anterior convexity point is usually directed anteriorly, but it may point antero-inferiorly. If the angle takes the form of a large arc, one should choose the anterior inferior convexity point of the arc for the orientation study, since the internal cerebral vein has a relatively straight course until it reaches the foramen of Monro, where it begins the sweep that forms the venous angle.

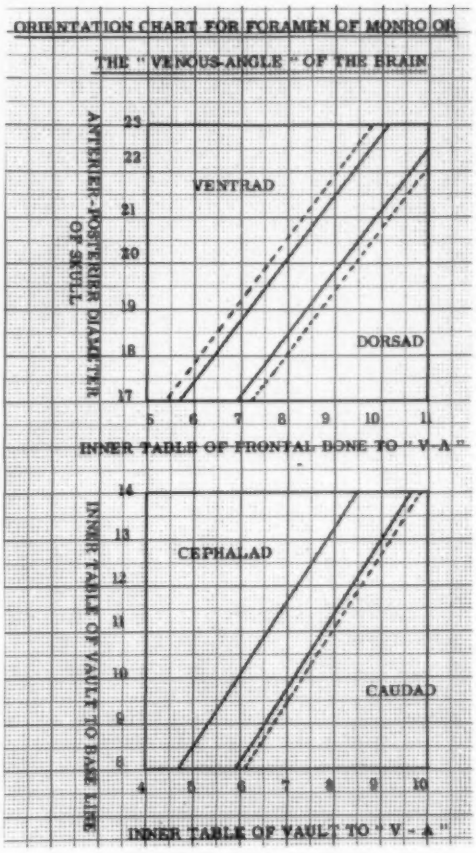
ORIENTATION CHART FOR FORAMEN OF MONRO OR
THE "VENOUS-ANGLE" OF THE BRAIN
ANTERIOR-POSTERIOR DIAMETER OF SKULL
VENTRAD
DORSAD
INNER TABLE OF FRONTAL BONE TO "V-A"
INNER TABLE OF VAULT TO BASE LINE
CEPHALAD
CAUDAD
INNER TABLE OF VAULT TO "V-A"

Fig. 14. Orientation chart for localizing the foramen of Monro or the "venous angle" of the brain. The normal range of variation of the "venous angle" in the ventrodorsad direction is represented by the broken lines; in the cephalocaudad direction the normal range of variation is shown by the anterior solid line and the posterior broken line.

B. Draw the base line, *B*, joining the nasion and the tuberculum sellae and extending beyond the latter.

C. Draw a perpendicular line from the base line, *B*, passing through point *A* to

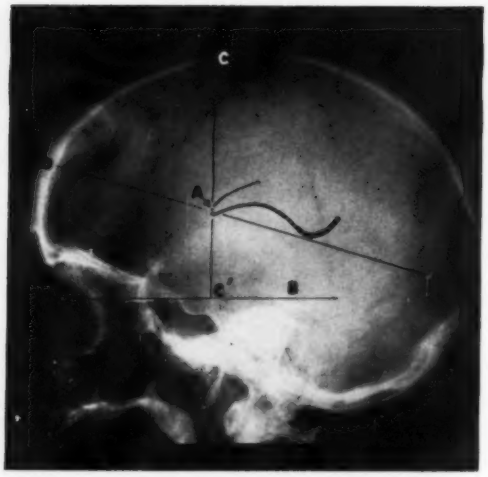

Fig. 15. Method of orientation of the "venous angle." Base line, *B*, passes through the nasion and tuberculum sellae. Orientation in the cephalocaudad direction: measure *C-A* against *C-C'*. Orientation in the ventrodorsad direction: measure the longest anteroposterior diameter *D-D'* against *D-A*. Reproduced, by permission, from Lin, Mokrohisky, Stauffer, and Scott: J. Neurosurg. **12**: 256–277, May 1955.

reach the inner table of the skull at the vault. The distance from the inner table of the vault to point *A* is called *C* and the distance from the inner table of the vault to the base line is called *C'*.

D. The distance from point *A* to the inner table of the frontal bone (the longest distance) is called *D*.

E. The longest distance in the anteroposterior diameter of the skull measured from the inner table of the frontal bone to the inner table of the occipital bone is called *D'*.

F. Chart *C* against *C'* for determination of cephalic and caudal displacement of the venous angle.

G. Chart *D* against *D'* for determination of dorsal and ventral displacement of the venous angle.

One hundred "normal" cases were used for orientation of the venous angle by the above method. The justification for calling these cases normal has been explained earlier in this paper. The solid limiting lines shown on the chart (Fig. 14) represent a range of 12 mm. Orientation in the cephalocaudad direction showed 98.7 per cent of normal cases to fall between these lines, whereas orientation in the ventrodorsal direction showed 92.2 per cent of the normal cases between the solid limiting lines. The larger variation in ventrodorsal orientation is due to differences in the shape of the skull. In dolichocephaly the venous angle has a tendency to be displaced ventrad, while in brachycephaly the tendency is to dorsal displacement. During the early part of our investigation, we thought the limiting range represented by the solid lines would be sufficient to include all normal cases. With further experience, we found it necessary to extend these lines in order to include our widest variants. If all the normal cases were to fall within two limiting lines, a range of 14 mm. was required when the venous angle was orientated in the cephalocaudal direction. This is shown on the chart by the anterior solid line and the posterior broken line. The posterior broken line was added to include 1 case falling less than 2 mm. posterior to the solid line. The normal range of variation in the position of the venous angle in the ventrodorsal direction was found to be 18 mm. in the 100 normal cases reviewed. This is shown on the chart by the two broken lines. The anterior broken line was added in order to include 2 cases falling less than 3 mm. anterior to the ventral solid line, and the posterior broken line in order to include 4 cases falling less than 3 mm. posterior to the dorsal solid line.

In all our supratentorial space-taking lesions proved by surgery or autopsy, we found the venous angle to fall outside our narrower limiting range in 55 per cent of cases and outside our wider limiting range in 37 per cent of cases. In many instances it fell out of the wider limiting range in two directions. The most common displacement was in a caudad direction (50 per cent), next ventrad (25 per cent), next dorsad (15 per cent), and cephalad (10 per cent). In only 15.5 per cent of his pathological cases, did Johanson find the venous angle to fall outside a circle 22 mm. in diameter.

Utilizing the template devised by Wolf *et al.*, we found a high percentage of our tumor cases falling beyond their set limiting lines, but we also found many (20.5 per cent) normal variants falling beyond these limits. Because of this wide overlap of pathological and normal cases, we do not consider the template of reliable diagnostic value. These authors stated: "It is possible that, with further experience, the safety range may be somewhat narrowed." We have found the opposite to be true, as shown by the wide range of normal variation in our measurements, as well as those of Johanson.

A consideration of the various types of displacement of the deep cerebral veins by intracranial space-taking lesions in various locations is beyond the scope of this paper.

DISCUSSION

The deep veins form a fairly constant pattern with a certain range of normal variation. Some of these variants may be mistaken for abnormality. Changes in the position and configuration of the deep veins may nevertheless provide significant localizing evidence, suggest the extent of disease, or aid in determination of operability.

Venous tributaries to the internal cerebral vein occur in a significant percentage of cases to cause difficulty in localizing the foramen of Monro. Direct inspection or objective measurement of false venous angles formed by these tributaries results in misleading information which may be considered of pathological import. It is important, also, to recognize the normal range of variation of the other deep cerebral veins. Borderline changes in pathological cases closely simulate normal variants and should be interpreted with caution. Normal variations in the appearance of the great vein of Galen and the inferior sagittal and straight sinuses are less important, since these structures are rarely displaced or distorted, due to their fixed attachments to the falx and tentorium.

Previous reports on cerebral phlebography indicate that considerable confusion often arises in trying to differentiate between superficial and deep veins on the lateral phlebogram. We have been able to eliminate this problem by stereoscopic films. This method has also helped us in identifying the course and position of tributaries to the internal cerebral vein, which can easily be confused with the true venous angle on conventional films. Potential errors due to rotation of the skull were also excluded by stereoscopic visualization. The usual problem with conventional films is that rotation around a horizontal axis causes the normal curves of the deep mid-line veins to become less marked, whereas rotation around a vertical axis causes foreshortening of these veins and exaggeration of their curves. Rotation around a horizontal axis also causes apparent upward or downward displacement of the basal vein of Rosenthal.

Information obtained from the lateral phlebogram is at times difficult to analyze because of the fairly wide range of normal variations of the cerebral vessels. Displacement or distortion of the venous angle or internal cerebral vein may be obvious on direct inspection; however, unless one has a well fixed mind's-eye picture of the position and configuration of these structures, it is possible to question or disregard such findings. Objective measurements in these cases may aid in formulating a decision. However, should the measurements be within the normal range of variation, it is not possible to exclude a pathological condition, since a high percentage of tumors (45–63 per cent) will not displace the venous angle outside the limiting lines set for normal variants in the chart presented (Fig. 14). Only 37 per cent of our tumor cases were found to displace the venous angle beyond the wider limiting range in any direction.

Measurements for localizing the venous angle of the brain on the lateral phlebogram are, therefore, a useful objective means of obtaining supplementary information which may corroborate other vascular changes or neurological findings. We have found that additional measuring

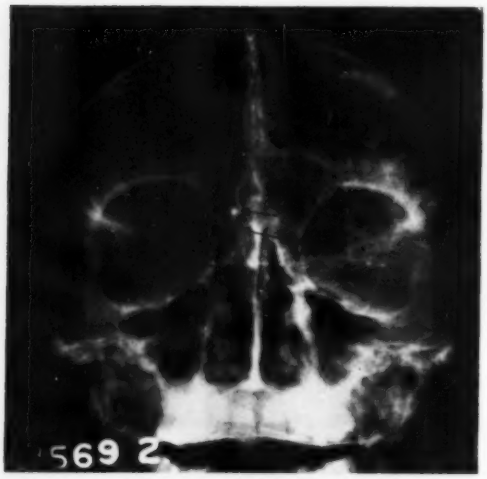

Fig. 16. Anteroposterior phlebogram showing displacement of the "venous angle" and internal cerebral vein across the mid-line. A vascular meningioma was removed from the posterior portion of the left frontal lobe.

points along the course of the internal cerebral vein are hard to define on the basis of the shape of the vein alone. We feel that the mid-point and lowermost posterior point of the internal cerebral vein are best evaluated by direct inspection rather than by objective measurements.

We have found the anteroposterior phlebogram to be of great value in arriving at a definite decision, not only in determining the hemispheric side of the lesion, but also in more accurately localizing it. Combining the findings on the anteroposterior phlebogram and arteriogram, one can localize the lesion anteriorly if the anterior cerebral artery alone is displaced; further back in the frontal lobe when both artery and internal cerebral vein are displaced (although a cerebral tumor in any location associated with generalized cerebral edema of that hemisphere may give the same picture); and still further back in the frontal or parietal lobe when displacement of the vein is greater than that of the artery. Such changes, along with pattern distortions, give more localizing information. Stereoscopy aids in determining the presence or absence of lateral shift of the internal cerebral vein through the relationship of this vein to mid-line bony structures and the contrast-filled superior and inferior sagittal sinuses. Displacement of the venous angle or internal cerebral vein alone to the opposite side of the mid-line a distance of only a few millimeters can be regarded as pathological (Fig. 16). On the other hand, the exclusive finding of displacement or distortion of these structures on the lateral phlebogram must be interpreted with caution.

SUMMARY

1. On the basis of 400 cerebral angiograms obtained with the Chamberlain biplane, stereoscopic, rapid-sequence angiographic unit, the anatomy and normal range of variation of the deep cerebral veins and dural sinuses have been described. Some of the advantages of this unit are discussed.

2. The true "venous angle of the brain" indicates the site of the foramen of Monro. A chart for measuring this landmark in normal and abnormal cases has been presented and its value discussed.

3. Normal variants or tributaries of the internal cerebral vein result in a false "venous angle of the brain." These variants occur in a significant percentage of cases and may be mistaken for abnormal displacement of the venous angle.

4. The deep cerebral veins have limitations in diagnosis due to their wide range of normal variation.

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SUMARIO

La Importancia Diagnóstica de las Variaciones Normales en la Flebografia Cerebral Profunda, Haciendo Hincapié en el Verdadero y el Falso "Angulo Venoso del Cerebro" y Justipreciación de las Mediciones de Este Angulo

El agujero de Monro constituye un constante punto de referencia intracraneal que se considera importante para la localización de las lesiones intracraneales que toman espacio. Puede determinarse su situación observando el "ángulo venoso del cerebro," formado por la unión de las venas estriotalámica y cerebral interna. Sin embargo, las variantes normales o tributarias de la vena cerebral interna, que se observan en un grupo crecido de personas, pueden producir un "ángulo venoso falso" y conducir a un diagnóstico erróneo de desplazamiento del "ángulo venoso verdadero."

Se emprendió un repaso de 400 angiogramas cerebrales para descubrir esas variaciones normales, y se discuten pautas que permiten reconocerlas. Se dedujo que la amplia escala de variaciones observadas normalmente limita el valor de las venas cerebrales profundas en el diagnóstico. No obstante, las alteraciones de su posición y configuración pueden suministrar suficientes datos localizadores, sugerir la extensión de una lesión y ayudar en la determinación de la operabilidad.

Se describe una gráfica para la ubicación del ángulo venoso y se discute su valor. Se descubrió que las radiografías estereoscópicas poseen ventajas bien definidas para la diferenciación entre las venas superficiales y profundas, la identificación del trayecto y de la posición de las tributarias de la vena cerebral interna y la exclusión de errores debidos a la rotación del cráneo.

The Results of Radiotherapy of Bronchial Cancer[1]

L. H. GARLAND, M.D., and M. A. SISSON, M.D.

THE RISE IN bronchial carcinoma deaths in the last two decades suggests that the place of radiotherapy in the treatment of this disease should again be reviewed. It is estimated by one observer that about 2 per cent of males now living will have bronchial cancer (16). In the population of the United States at large, the 1953 death rate from this cause was approximately 14 per 100,000; in males between the ages of sixty and seventy, it was about 100.

The prevalence rate (*i.e.*, the number of persons living at any one time with bronchial cancer, per 100,000 living persons) is reported at widely differing levels in different parts of the country. In the entire United States it is calculated to be between 1 1/2 and 1 2/3 the mortality rate. For the year 1953, for example, the approximate prevalence rate for males over forty-five was 110, and for males of sixty to seventy about 160 (7, 17).

There is disagreement in the literature as to the efficacy of radiotherapy in bronchial cancer, even when used for palliation (10, 13, 21, 22). This is understandable in view of the short survival of most patients and the fact that irradiation is often deferred until the disease is advanced. Those who have employed radiotherapy extensively, however, report favorably on its usefulness in properly selected cases and emphasize that, while survival time is seldom prolonged, the patient is usually made more comfortable.

The most effective curative treatment for carcinoma of the lung remains resection, simple or radical, depending on the stage and type of disease and the condition of the patient. The proportion of patients eligible for curative resection remains relatively small, however, ranging from about 20 per cent of those having symptoms to about 40 per cent of those without, the latter largely representing x-ray survey-detected cases. *Between 80 and 60 per cent of persons with bronchial cancer*, therefore, are still not amenable to curative surgery at the time their tumor is diagnosed. The results of radiotherapy in a series of patients in this group will be considered.

MATERIAL

Two groups of cases were studied, (*A*) patients seen at the San Francisco Hospital during the last two and a half decades and (*B*) patients seen in private practice during the last decade.

(*A*) The San Francisco Hospital is a 1,200-bed institution for the care of the indigent; it is a teaching hospital, staffed by physicians from the two medical schools in the city, and does not maintain an active outpatient clinic.

The recorded cases diagnosed as bronchogenic carcinoma during the period of study numbered 623. Convincing cytologic or histologic data were lacking, however, in 103 cases, and therefore only 520 are included in the present summary. This group consisted of 468 males and 52 females (a ratio of 9:1); the average age was 60.6 years (the range being twenty-four to ninety). Many patients were admitted as terminal cases, and survived less than four weeks after admission.[2]

The radiological classification of discernible or presumed lesions at the time of diagnosis, based on the available films, was as follows:

Central (*i.e.*, apparently near the hilus)	66 per cent
Peripheral (*i.e.*, in the outer half of the lungs)	34 per cent

[1] From the Department of Radiology, Stanford University Medical School Service, San Francisco Hospital, San Francisco, Calif. Accepted for publication in July 1955.

[2] We are indebted to the staffs of both the University of California and the Stanford Medical Schools for permission to review their cases of bronchial cancer in this report.

The pathological classification, based on autopsy material in 369 cases and on biopsy or cellular material in 151 cases, was as follows:

Squamous-cell (epidermoid)	168 (32 per cent)
Anaplastic (undifferentiated and oat-cell)	138 (27 per cent)
Adenocarcinoma	64 (12 per cent)
Alveolar-cell carcinoma	10 (2 per cent)
Unclassified carcinoma	140 (27 per cent)

Of the entire group of 520 cases collected up to 1953, 501 were traced at the time of this report. The traced dead numbered 498; in 10 of this group the records were inadequate and in 18 the lesions, which were very small, were discovered incidentally at autopsy. There are thus available for review 470 fatal cases. Some of the subsequent tables are based on this number. It should be noted that in some of these patients, both treated and untreated, death was due not to lung cancer but to other causes, such as cardiovascular disorders, primary neoplasm elsewhere, suicide, etc. At least 14 cases fell within this category.

The group of 520 proved cases may be divided into two groups: (*a*) cases accepted for definitive treatment, 144; (*b*) cases not definitively treated at the San Francisco Hospital (terminal cases which had been given definite treatment elsewhere, cases given only supportive treatment, treatment refused, or tumor first found at autopsy), 376.

Cancer was first discovered at autopsy in 105 patients; in 18 of these, the lesions were very small (apparently incidental and silent); in the remainder, tumors were found which either definitely or presumably contributed to the patient's death. These had supposedly been masked by associated pneumonia or effusion or had been overlooked, or chest roentgen examination had not been requested.

(*B*) The *private patients*[3] numbered 41, referred by physicians in the San Francisco area. All were inoperable or had refused operation and all had symptoms warranting acceptance as suitable for radiotherapy. Most were ambulatory at the time of treatment. In 3 cases the diagnosis was based on clinical and radiological evidence only; in the remainder cytologic or histologic proof of bronchial carcinoma was obtained. The 3 non-biopsied patients subsequently died with signs and symptoms of bronchial cancer. The group was composed of 36 males and 5 females, the average age being sixty-two (forty-four to eighty years).

The radiological and pathological classifications were similar in general to those of the hospital patients, with the relative proportion of squamous-cell tumors a little higher.

All but 1 of the private patients have been traced.

[3] Private practice of Drs. H. A. Hill, M. E. Mottram, M. A. Sisson, and L. H. Garland.

TREATMENT

The group of 144 *treated* hospital cases was divided as follows:

Surgical treatment	61
Radiotherapy	67
Exploratory surgery followed by radiotherapy	16

For purposes of subsequent comparison it may be noted that the surgical cases were classified as follows:

Exploration, 46 (14 of which received subsequent x-ray therapy)
Resection, 31 (2 of which received subsequent x-ray therapy)

The resections consisted of 27 pneumonectomies and 4 lobectomies. In the entire group of 77 surgically explored or treated cases, there were 9 immediate postoperative deaths, and 5 more within the first week after operation. There has been 1 five-year survival to date.

The radiotherapy cases (67 given radiotherapy alone, and 14 in which exploration was followed by irradiation) were treated as follows:

Palliative course (less than 1,500 r tumor dose in four weeks)	39
Moderate course (1,500–3,000 r tumor dose in four weeks)	33
More radical course (3,500–5,000 r tumor dose in four to six weeks)	9

TABLE I: SURVIVAL AFTER RADIOTHERAPY IN 122 CASES OF BRONCHOGENIC CARCINOMA

Cases	Surviving over 12 Months	Surviving over 24 Months	Surviving over 36 Months
Hospital, 31	9	2	1
Private, 41	10	0	0

There were no deaths due to radiotherapy but some elderly patients were not able to complete the planned course of treatment.

All of the 41 private patients received radiotherapy, as follows:

Palliative only (less than 1,500 r)	4
Moderate course (1,500–3,000 r)	32
More radical course (over 3,000 r)	5

In most instances, a "moderate course" of radiotherapy was planned, *i.e.*, to deliver about 3,000 r throughout the tumor and its known or presumed regional nodes in about four weeks time. Not infrequently this plan had to be modified, because of progressive disease, systemic reactions, or other reasons. In a small number of apparently favorable cases, the plan was to deliver a potentially curative dose (about 5,000 r tumor dose in four weeks), but this was not often accomplished. The technical factors were: orthovoltage (200 to 250 kv), with filtration to give a half-value layer of from 1 to 2 mm. copper; target-skin distances of 50 to 70 cm.; skin fields of from 10 × 10 to 20 × 20 cm., often irregular in shape to conform to the primary tumor and the enlarged nodes. Multiple small fields were used for radical dosage; two to four larger fields for palliative or moderate dosage. In most instances fluoroscopic and radiographic checks on beam centering were employed. Mild antihistaminic or sedative medication generally preceded irradiation. Dosage was graduated to minimize significant systemic, pulmonary, or cutaneous reactions. Nitrogen mustard, cortisone, ACTH, and curare were not used in conjunction with irradiation, though in a few cases cortisone was given pre-terminally by the referring physician after the conclusion of radiotherapy. Grid and rotation devices were not regarded as meriting employment in the treatment of our cases. A few of the responsive patients received second courses of radiotherapy when symptoms recurred at least several months after a first nonradical course.

RESULTS OF TREATMENT

The average period of *survival after treatment* in the 81 cases from the San Francisco Hospital was 5.3 months, with a range of one to thirty-six months. In the 41 cases treated in private practice, the average survival time was 8.3 months, the range being a month and a half to nineteen months, excepting 1 patient who survived five years and is not included in these statistics. These private patients formed, of course, a relatively selected group. Variation in the extent and the biological type of tumor may have accounted for the difference in average survival time in the two series of cases; better nutritional status in the private cases may also have been a factor.

The patient who survived for five years after irradiation was a man of sixty-nine, with a clinical and radiological diagnosis of carcinoma of the right upper lobe bronchus. He complained of cough, chest pain, and weight loss, and cytologic findings were positive. Regarded as inoperable, he was given a tumor dose of 3,000 r to a large area, in divided dosage; death, five years later, was due to cardiac disease. At coroner's necropsy, a small tumor was found in the right upper lobe, but no sections were obtained. The old cytologic smears were then re-examined by Dr. S. Farber, and the original diagnosis questioned. This case is therefore excluded from this report.

In combining the two series of cases, it was found that 19 of 122 patients (16 per cent) survived for one year after radiotherapy, 2 of 110 patients (2 per cent) survived two years, and 1 of 90 patients survived three years (Table I). The average survival time of all cases after radiotherapy was 6.2 months.

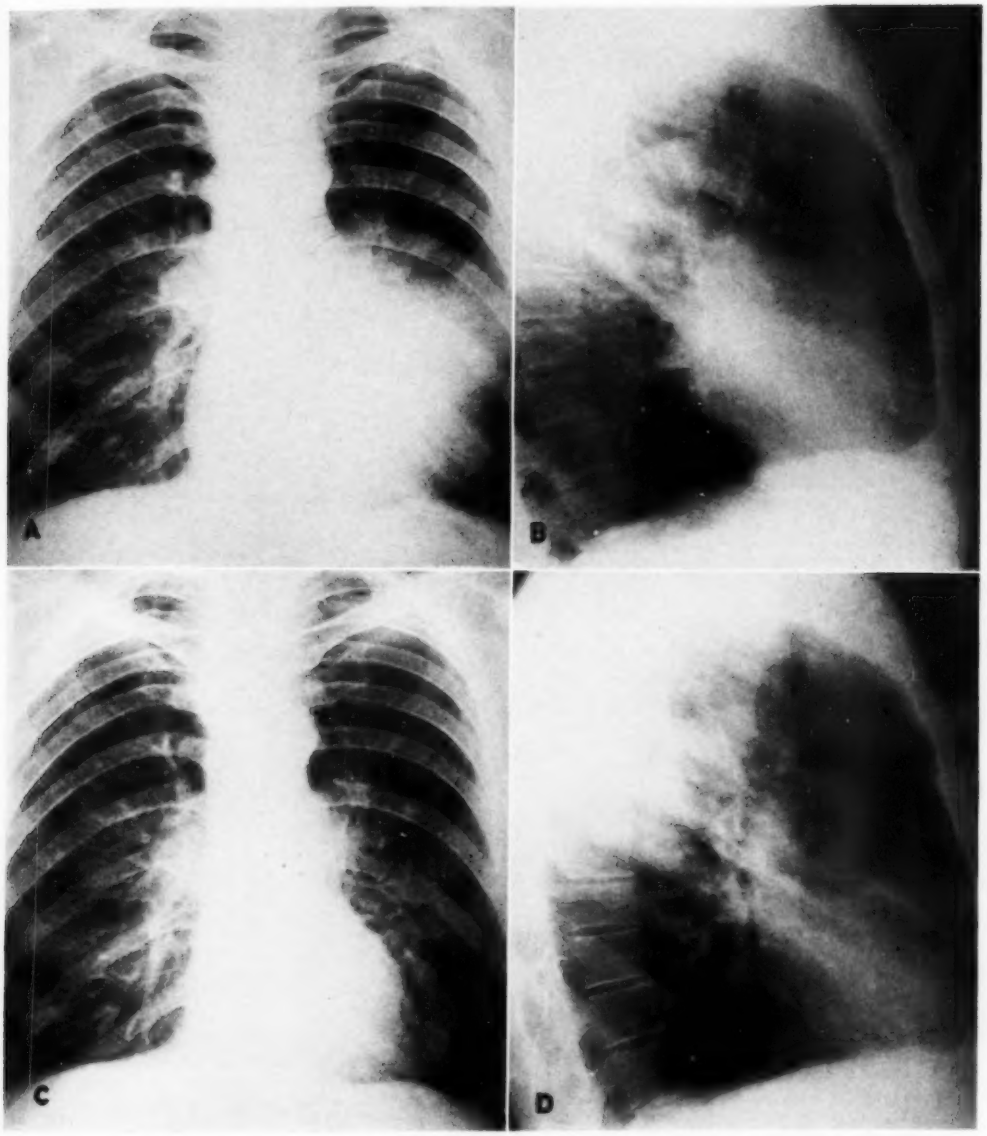

Fig. 1. Male, 47, with severe cough and left chest pain. Trachea was fixed and patient was regarded as inoperable.

A and B show partial collapse and consolidation of lingula. Bronchoscopy revealed tumor in lingular division of left upper lobe bronchus. *Pathological diagnosis:* Anaplastic carcinoma.

C and D. Same patient two months after radiotherapy (3,500 r, tumor dose, in five weeks to an oval area measuring 20 cm. in maximum diameter). Symptoms relieved and patient able to return to work for approximately nine months. Survived twelve months following radiotherapy.

The measurement of *relief of symptoms* is admittedly unprecise and subjective; nevertheless, it is a generally accepted method of recording response to therapy of any type. The results in the hospital cases were as follows: Cough was relieved in approximately 60 per cent of the cases, pain in 60 per cent, hemoptysis in

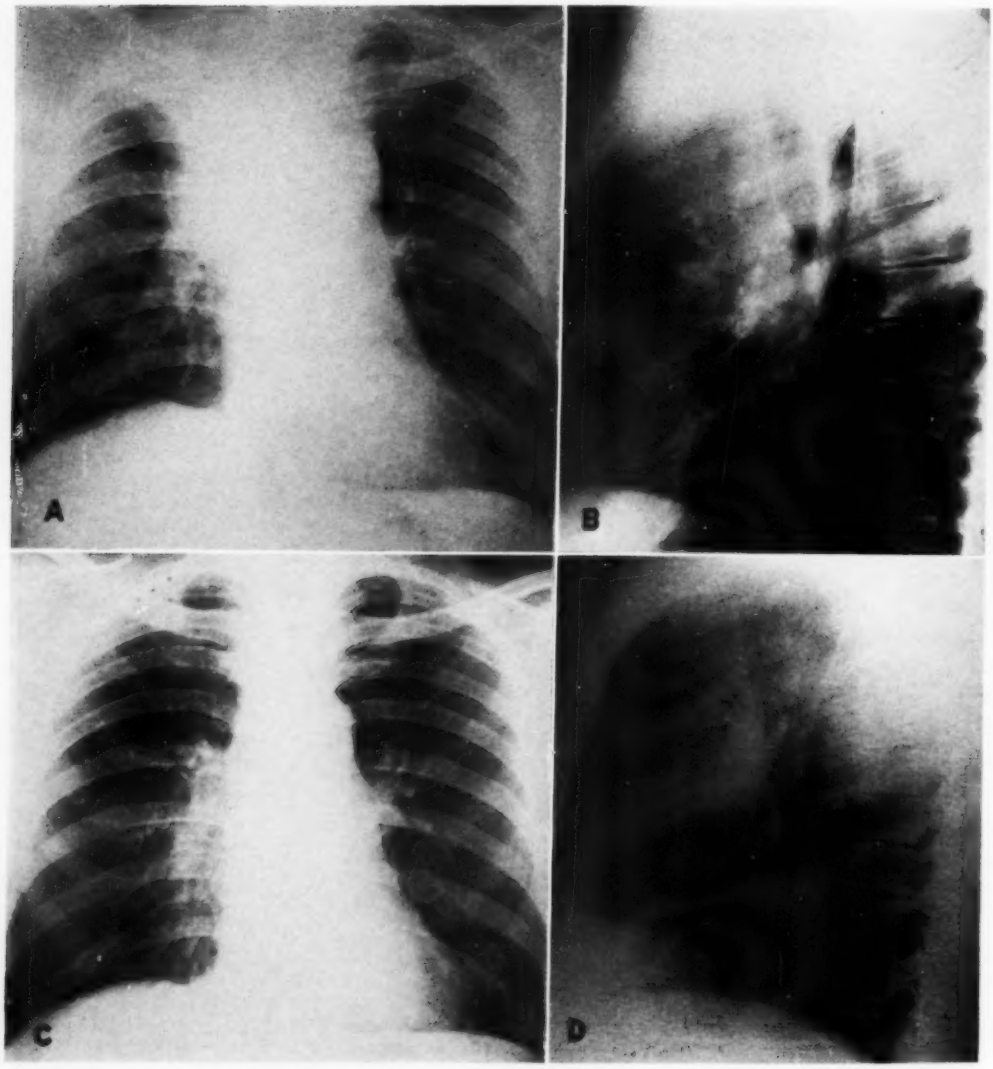

Fig. 2. Male, 56, with cough, hemoptysis and weight loss. Carina fixed and patient regarded as inoperable. A and B show atelectasis of right upper lobe and enlargement of right hilus. Bronchoscopy revealed tumor in right upper lobe bronchus. *Pathological diagnosis:* Anaplastic carcinoma. See Fig. 3.

C and D. Same patient three months after radiotherapy (3,200 r, tumor dose, in four weeks to an oval area measuring 14 cm. in average diameter). The patient gained weight and returned to work. He lived for one year and died with symptoms of metastases.

75 per cent, and mediastinal obstruction in 50 per cent (only 4 cases with this last symptom). The clinical records of 67 patients were sufficiently complete to warrant the summary given in Table II.

The fact that in no case were symptoms apparently made worse by treatment is presumably due to the moderate total dosage used, and the graduated increments employed.

Experience with the private cases paralleled that of the hospital series.

Possible Influence of Dosage on Results: Experience with the San Francisco Hos-

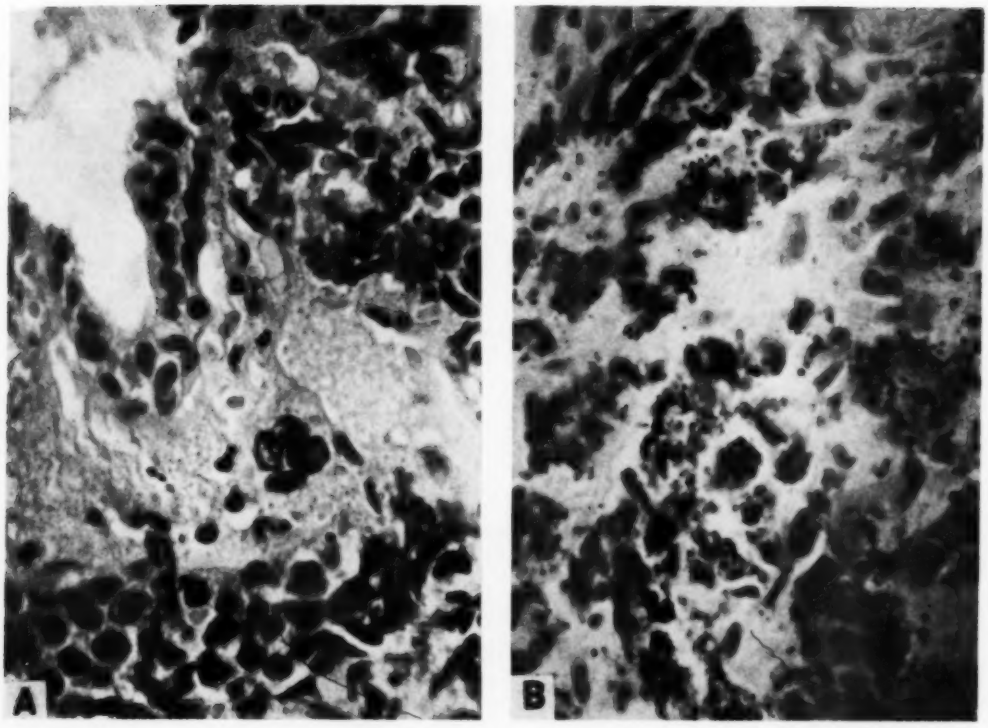

Fig. 3. Tissue from patient shown in Fig. 2.
A. Tissue from bronchoscopic specimen: Anaplastic carcinoma of right upper lobe bronchus.
B. Tissue from same bronchus at autopsy twelve months later, showing pyknosis, calcification, and marked disorganization of the cells, with no microscopic evidence of viable tumor. Similar changes were noted in the regional nodes within the field of radiotherapy. However, in some low mediastinal nodes and some left supraclavicular nodes (both outside the field of radiotherapy) the cells appeared as in the original tumor. At autopsy the patient had no evidence of residual tumor in the treated zones, but did have extensive tumor in various lymph nodes, both adrenals, and the liver. This patient evidently had a very radiosensitive tumor but one which was probably already disseminated at the time of diagnosis.

pital series suggested that increase in tumor dose resulted in an increased *survival time* (Table III). The number of cases available for analysis is small, however, and the natural variation in survival of untreated patients is too great to permit conclusions. In addition, the experience with private patients proved quite contradictory (Table IV). Of the 41 private cases, 1 is not included in the survival data because of surgery performed some months following radiotherapy; this patient had but little residual tumor at operation and lived five years. One patient is still untraced;

TABLE II: RELIEF OF SYMPTOMS AFTER RADIOTHERAPY IN 67 CASES OF BRONCHOGENIC CARCINOMA

Symptoms	Number of Cases	Per Cent of Cases Showing Improvement		
		Marked	Moderate	None
Cough	50	6	54	40
Pain	34	6	54	40
Hemoptysis	25	60	15	25
Mediastinal obstruction	4	0	50	50

TABLE III: APPARENT INFLUENCE OF TUMOR DOSE ON SURVIVAL (HOSPITAL SERIES)

Cases	Tumor Dose	Average Survival Time after Treatment
39	Less than 1,500 r	3.7 months
33	1,500 to 3,000 r	6.0 months
9	Over 3,000 r	10.1 months
81		5.3 months

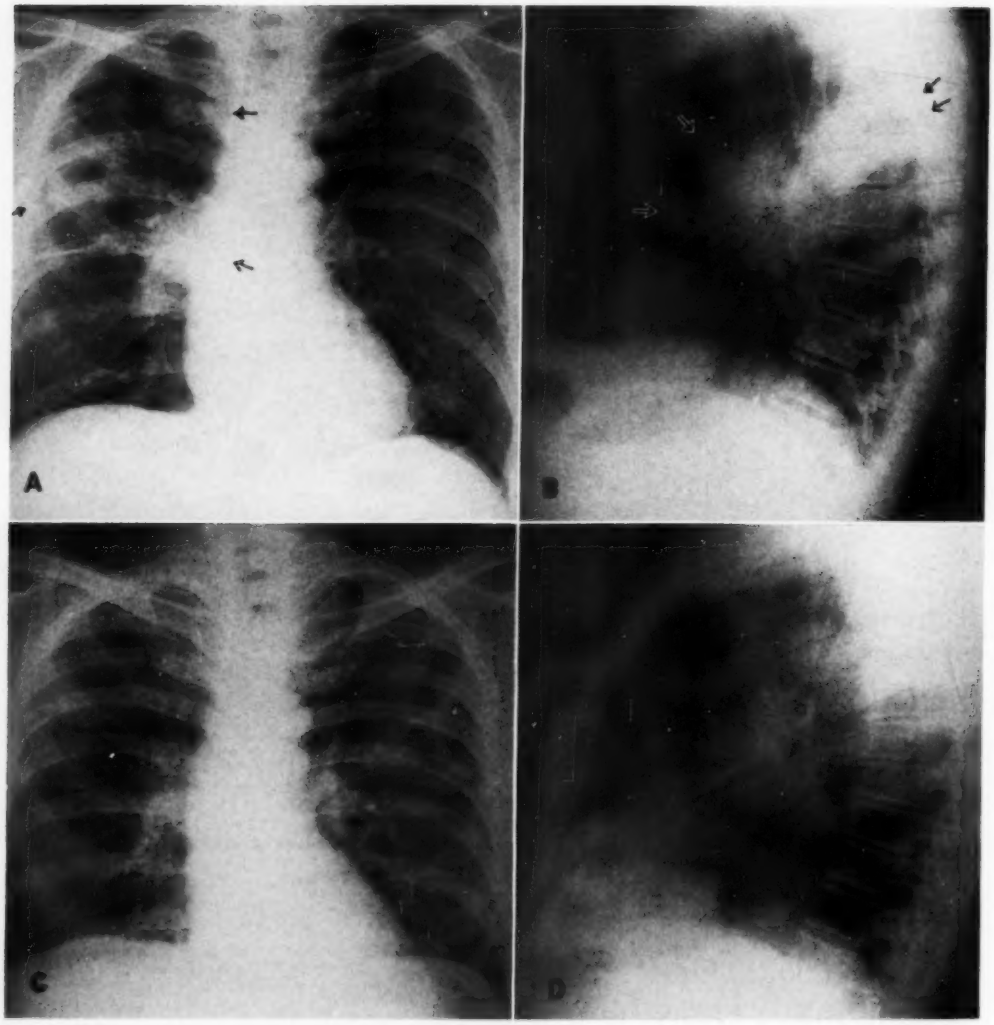

Fig. 4. Male, 61, with severe cough and dyspnea.

A and B show necrotizing lesion in right upper lobe with hilar and paratracheal adenopathy. Bronchoscopy revealed tumor in right upper lobe bronchus extending into main bronchus. *Pathological diagnosis:* "Oat-cell" carcinoma.

C and D. Same patient three months after radiotherapy (3,600 r, tumor dose, in five weeks to oval field 20 cm. in maximum diameter). Symptoms were relieved and the patient returned to work. He was living more than a year following radiotherapy.

he was eighty years old at the time of treatment and has probably died of intercurrent disease, if not of carcinoma.

The experience with the hospital series suggested that relief of symptoms was slightly greater with more adequate dosage. About 60 per cent of all patients treated obtained relief of cough and pain. If data were limited to those receiving more than 1,500 r tumor dose, this figure would be increased to about 80 per cent. Observations in the private series were comparable.

Apparent Influence of Histologic Type of Tumor on Response to Therapy: No consistent correlation was discovered between

the type of tumor treated and average *survival time*. It was our impression that the more anaplastic or oat-cell type responded best to radiotherapy. This is partly borne out by the following figures, based on the hospital series:

Histologic Type	Average Survival Following Radiotherapy
Squamous-cell	4.2 months
Anaplastic	6.5 months
Adenocarcinoma	5.8 months
Unclassified carcinoma	4.4 months
All cases	5.3 months

Comment: Carcinoma of the lung is a tumor of rapidly lethal potential. A small number of cases, perhaps as many as 20 per cent, have a fairly long natural course (two or more years from initial signs or symptoms to death); most untreated cases survive only a few months after diagnosis.[4]

In general, the shorter the duration of symptoms, the shorter also is the duration of life after their onset (4, 9, 18), a paradox recognized in tumors of many other sites, as in the breast and stomach. This results in an automatic tendency for the biologically more favorable cases to reach treatment, and for survival to reflect not the treatment but the type of tumor present. Inherent malignant potential, and not early diagnosis or radical treatment, is doubtless a prime factor in survival.

TABLE IV: APPARENT INFLUENCE OF TUMOR DOSE ON SURVIVAL (PRIVATE SERIES)

Cases	Tumor Dose	Average Survival Time after Treatment
4	Less than 1,500 r	8.1 months
28	1,500 to 3,000 r	10.5 months
7	Over 3,000 r	7.7 months
39		8.3 months

TABLE V: AVERAGE SURVIVAL TIMES (IN MONTHS) OF 470 PATIENTS DYING WITH BRONCHOGENIC CARCINOMA

Cases	From First Symptom to First Visit to Physician	From First Visit to Definitive Treatment	From Definitive Treatment to Death	Total Duration
Untreated, 329	5.1	——3.2——		8.3
Treated, 141	6.1	2.9	4.9	13.9

The "profile" of bronchogenic carcinoma at the San Francisco Hospital was studied and will be the subject of a separate detailed report by Dr. R. V. Karlen. He reviewed the charts of all patients with diagnoses of bronchial cancer and recorded the first chest-related symptom, such as cough, chest pain, dyspnea, hemoptysis, or weakness. Some patients, of course, had no chest-related symptoms; others gave unreliable or inadequate histories. The average time between this first symptom and the first visit to a physician was found to be *5.3 months*. The average time between that visit and death in the untreated cases was 3.2 months, and between that visit and definitive therapy in the treated cases 2.9 months. The average survival following definitive therapy of any type was 4.9 months. These observations are summarized in Table V.

The treated group was composed essentially of those who were going to live long

[4] With reference to duration of diagnosable tumor, Rigler (26) believes that most cases of bronchogenic cancer produce x-ray changes recognizable about ten months prior to symptoms. This conclusion is based on an analysis of 90 cases (out of 400) in which prior films were available for review.

Richman (25) studied 270 cases of bronchogenic carcinoma, of which about one-sixth had previous films available. In 18 cases, roentgen evidence of tumor was present for twelve or more months; this is 7 per cent of the entire group (and about one-third of the group with serial films).

In our own series, only a small number of cases with prior films was available for study. In a few of these, slow-growing tumors were present, and radiologically manifest (in retrospect), for months or years. It is estimated, however, that such neoplasms do not exceed 20 per cent of bronchial cancers. This does not mean that bronchial carcinoma is not a slow-growing tumor in its initial phase; it may, like carcinoma of the cervix, have a long pre-invasive or *in-situ* phase, but it is exceptional in our experience for this phase to produce roentgen findings.

Fulton (9) reported that in 20 per cent of a series of 1,610 cases, clinical symptoms were present for more than one year, but the number of patients with roentgen signs for that period of time was not indicated. The mean duration of symptoms in his series was two and a half months.

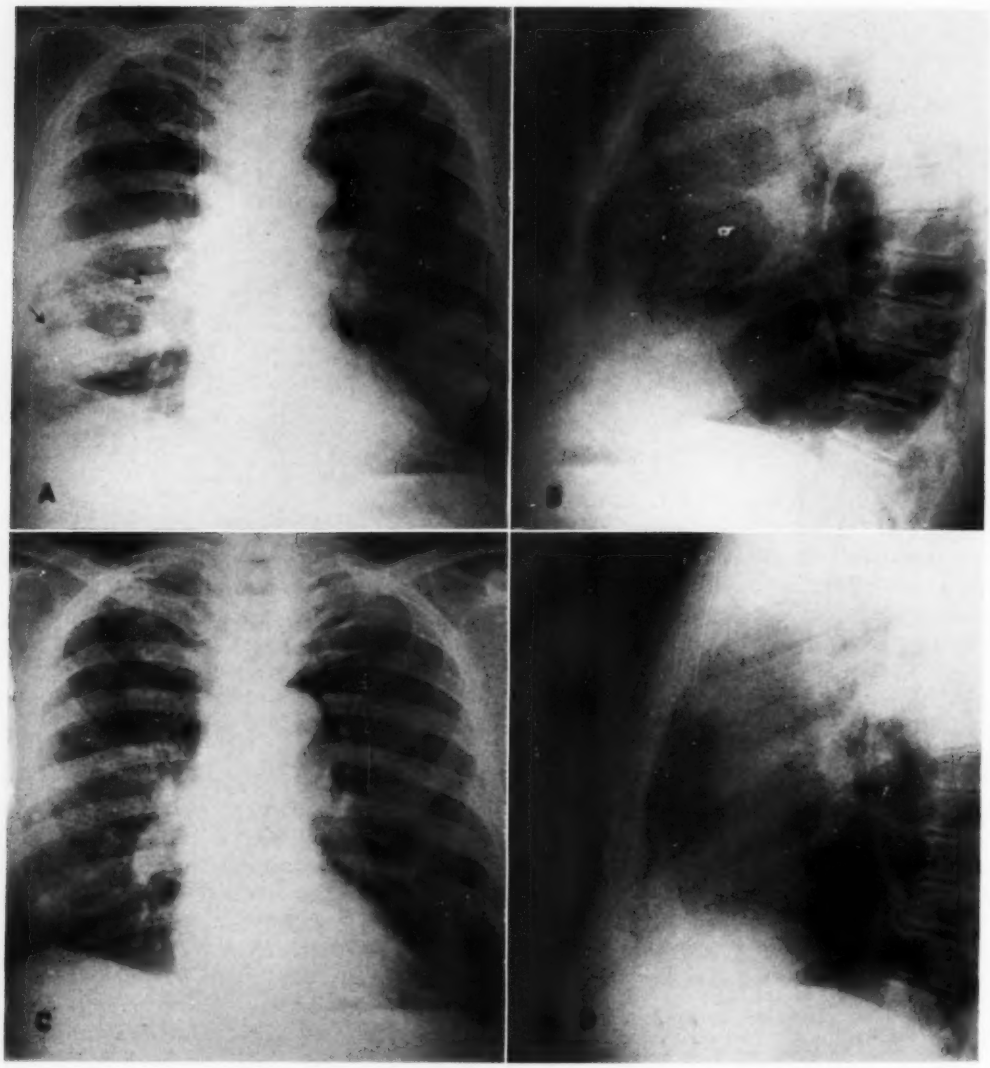

Fig. 5. Male, 64, with indigestion and moderate chest pain.

A and B show right lower lobe mass, with right hilar and paratracheal adenopathy and pleural thickening or fluid around portions of the middle and lower lobes. Bronchoscopy revealed tumor of right lower lobe bronchus. *Pathological diagnosis:* Squamous-cell carcinoma. Thoracotomy revealed inoperable lesions.

C and D. Same patient three months after radiotherapy (3,300 r in six weeks to a "J" shaped area, 23 cm. in maximum diameter). The patient's appetite improved; he gained weight and returned to light work. He survived one year.

enough to permit the application of definitive therapy. The data for this group are presented in Table VI ("surgery and irradiation" representing exploration followed by radiotherapy). No significant difference in survival times with the different forms of treatment is evident. The comfort of many of the patients, however, was improved by the surgical or radiation treatment, and survival after diagnosis was almost six months longer in the treated than in the untreated group.

Of 275 untreated patients who *survived a few months*, only 12 lived nine

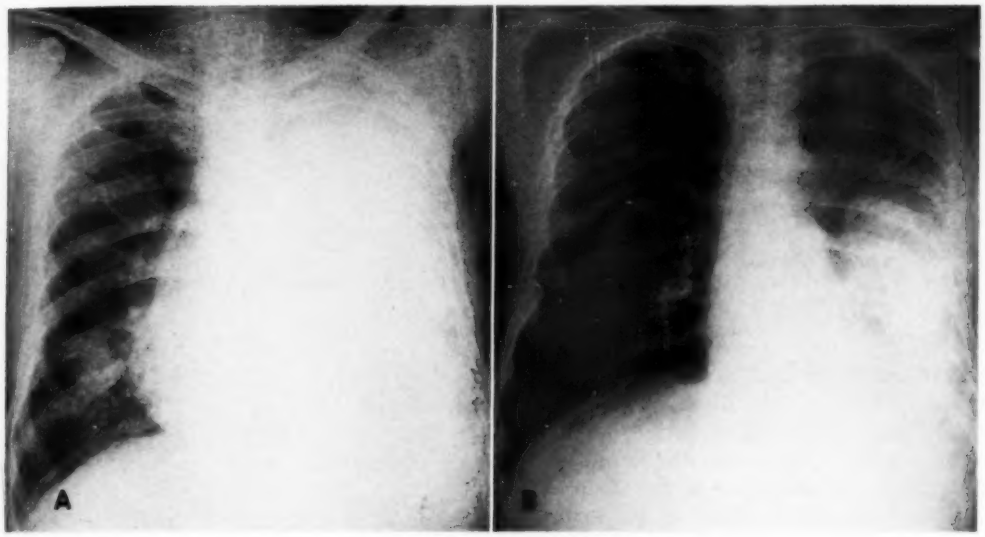

Fig. 6. Male, 58, with dyspnea and substernal distress.

A. Opacification of left hemithorax and small density in right lower lobe. Bronchoscopy revealed tumor of left main bronchus. *Pathological diagnosis:* Adenocarcinoma. Bone detail films showed destruction of left lower posterior rib cage.

B. Same patient eleven months after radiotherapy (1,500 r, tumor dose, in four weeks to a field 20 cm. in diameter, to include the left hilus, left lower rib cage, and right lower lobe density). Relief of symptoms for over six months. Survival twelve months following therapy.

TABLE VI: AVERAGE SURVIVAL TIME (IN MONTHS) OF 141 TREATED PATIENTS

Cases	From First Symptom to First Visit to Physician	From First Visit to Treatment	From Treatment (Surgery or X-Ray to Death)	Total Duration
Surgery, 58	6.1	3.5	4.0	13.6
Irradiation, 67	6.1	2.8	4.9	13.8
Surgery and irradiation, 16	6.1	1.4	7.8	15.3

months or more, 7 lived twelve months or more, and 1 lived over twenty-four months; survival was calculated from a point 2.9 months after the first visit to a physician, in order to equate the group with the treated cases.

Many authors (Fulton, 9; Ariel *et al.*, 2; Brooks *et al.*, 3) believe that increasing the dose (in favorable cases) results in increased survival. For example, Brooks and his associates report that the average survival of 70 patients given radical radiotherapy (over 4,000 r in six or more weeks) was 10.0 months after treatment, while in 95 patients given palliative treatment (less than the above dose) survival was 5.6 months. Others (Pohle and Siris, 23; Adelman, 1; Meredith Brown, 20) find no statistical evidence of trend toward increased longevity with increased tumor dose.

Holmes and Schulz (13) believe that radiosensitive lesions (*i.e.*, oat-cell carcinoma) can be destroyed with 3,000 r, while 5,000 r or more may be necessary for squamous-cell tumors.

In our series, 3 patients with undifferentiated bronchial cancer were apparently locally cured by tissue doses of only 3,500 r in four weeks; we know of many cases in which estimated doses of 5,000 r failed to cure. It is probable that most patients eligible for radiotherapy could tolerate the former dose without undue discomfort or late reaction, while few can tolerate the heavy dose without both early and late effects. It is for this reason that we have leaned to "moderate"

TABLE VII: BRONCHOGENIC CARCINOMA: AVERAGE SURVIVAL TIME IN MONTHS *from Onset of Symptoms* UNTIL DEATH

Author	Date	Untreated Cases	Treated by X-Rays (Inoperable)
Lindskog	1946	11.7	15.3
Shorvon	1947	6.2	11.0
Fulton	1949	7.6	11.8
Ariel *et al.*	1950	9.4	12.8
Brooks *et al.*	1951	...	15.7
Adelman	1952	...	14.3
Lea	1952	6.5	13.3
Garland and Sisson	1955	8.3	13.9

rather than "radical" dosage in this particular tumor. If the disease is limited in extent and at all radiosensitive, moderate dosage will achieve as much as heavy dosage in the majority of cases; if it is neither limited nor sensitive, no tolerable radical dosage will be of significant benefit.

Contraindications: Patients in poor general condition (attributable to age or concurrent disease) or with distant metastases should not be subjected to *radical* radiotherapy. *Palliative* radiotherapy, judiciously applied, may often be of aid in these categories.

RESULTS IN THE LITERATURE

The results of radiotherapy of bronchogenic carcinoma in terms of cure are so poor that one may reasonably question the diagnosis when a cure is claimed. For palliation, however, the method has a useful though somewhat neglected role. Palliation should be measured, when possible, by objective criteria, such as reduction in size of tumor, regression in size or number of metastases, decrease in mechanical pressure signs, and increase in survival time. Less valid, but still useful, are such subjective criteria as decrease in cough, pain, and dyspnea. Changes in appetite, weakness, etc., are difficult to evaluate.

Survival should be measured *from the initiation of treatment*, not from onset of the disease nor time of diagnosis. To use either of the latter is merely to measure the natural history of the disease; the former, at least in part, reflects the effect of the treatment employed.

Unfortunately, a surprisingly large number of the radiotherapeutic results recorded in the literature are based only upon survival after diagnosis or onset of symptoms (4, 6). The true effect of treatment,

TABLE VIII: BRONCHOGENIC CARCINOMA: AVERAGE SURVIVAL TIME IN MONTHS *from Admission to Hospital or Definitive Treatment* UNTIL DEATH

Author	Date	Untreated (Calculated from time of diagnosis)	Treated by X-Rays (Calculated from start of therapy)
Lindskog	1946	5.0	6.4
Fulton	1949	4.6	8.8
Ariel *et al.*	1950	...	4.5
Brooks *et al.*	1951	...	7.2
Adelman	1952	...	6.6
Tod	1952	2.6	5.0
Garland and Sisson	1955	3.2	6.2

therefore, is difficult to measure. Also, the irradiation itself is often reported in terms of the total air or skin dose and not of estimated tumor dose. Nevertheless, some reports do permit analysis, as shown in Tables VII and VIII. On the basis of these tables it will be noted that, *calculated from the onset of symptoms*, the average survival times in patients receiving radiotherapy range from eleven to sixteen months. However, when *calculated from the time of irradiation*, the average survival is only four to eight months.

Buchberg, Lubliner, and Rubin (4) studied 443 untreated patients with bronchial cancer at Montefiore Hospital, New York, and reported an average duration of life "from onset of striking symptoms to death, of 14.2 months." Furthermore, 15 per cent of the patients in this series survived two years, and 1.6 per cent five years. The authors note that the material is highly selected, owing to the fact that there is often a long period of waiting prior to admission to their institution, so that a number of individuals with rapidly progressive disease die either at home or in general hospitals before they have an opportunity to enter. This, of course, automatically filters out the short-duration cases.

Results of Megavoltage Therapy: Cantril (5) reported a series of 25 cases treated

Fig. 7. Apparent local arrest by radiotherapy. Male, 55, with cough, hemoptysis and pain in right upper chest.
A. Large area of consolidation or collapse in right upper lobe. *Pathologic report* on tissue obtained from right upper lobe bronchus: Adenocarcinoma. Patient refused operation.
B. Same patient two months after radiotherapy (3,000 r, tumor dose, in three weeks to an oval field 18 cm. in maximum diameter). Symptoms improved, but after nine months evidence of cerebral metastases developed and death ensued. At autopsy no residual tumor was evident in the right upper lobe bronchus area. Since adenocarcinoma is not usually so radiosensitive, it is possible that much of the primary lesion was removed at biopsy. Nevertheless, the case does illustrate the occasional favorable outcome as far as the local lesion is concerned.

with tumor doses of from 3,000 to 4,500 r. The average survival time from first symptoms to death in the treated cases was 11.9 months (as compared with eight months in untreated cases).

Hare (12) reported treating 25 cases with 2-MEV x-rays, delivering tumor doses of about 6,000 r in thirty-five days through two large opposing fields, if necessary including both hili, the entire mediastinum, and the supraclavicular area. Of 13 patients treated more than nine months previously, 3 were alive at the time of the report.

Holmes and Schulz (13) state that satisfactory palliation may be obtained with either supervoltage or orthovoltage beams, and report 1 five-year survival with orthovoltage therapy.

Meredith Brown (20) treated 192 patients with megavoltage x-rays (h.v.l. 9 mm. copper) and 66 with orthovoltage (h.v.l. 1.3–2.0 mm. copper) and concluded that "kilovoltage or technique do not seem to alter the chance of improvement provided the patient receives over 2,000 r tumor dose." About 42 per cent of the cases treated with 200 kv and 48 per cent of the 1,000-kv cases were improved.

Haas, Harvey, and Langer (11) compared the effects of 23-MEV betatron therapy and orthovoltage therapy in a small number of cases but did not publish specific data on the results in the two groups.

Nitrogen Mustard Therapy: Lynch *et al.* (19) report a series of 60 cases in which nitrogen mustard was employed. They believe that it produces relief for short periods of time, especially in patients with undifferentiated tumors. The average survival time after treatment was *3.9 months* in the patients who died and *5.1 months* in the patients still living, indicating that, as a therapeutic agent, it is certainly not superior to radiotherapy. These workers note that nitrogen mustard is a "potent toxic agent with lethal effects on tissues

other than those of the tumor," producing "nausea, vomiting and loss of appetite," without "the occasional prolonged survival seen with roentgen-ray therapy."

Fulton (9) observes that nitrogen mustard was of no benefit in his cases; "on the contrary, it appears to have hastened the end."

The combined use of nitrogen mustard and radiotherapy has been advocated by some workers, but no really encouraging reports have been published (24, 27).

DISCUSSION

After diagnosis, the average survival time of patients with bronchogenic carcinoma (treated or untreated) is considerably shorter than many clinicians appear to realize. The occasional patient who shows a long survival, either spontaneous or related to treatment, tends to remain uppermost in the mind. The present outlook in bronchogenic carcinoma might be summarized as follows:

Of 100 unselected patients with bronchogenic carcinoma, about one-half are inoperable at time of diagnosis and about one-half are eligible for exploration. Of the latter, about half will prove to be inoperable and the other half resectable. Of the 25 resected patients, 1 will usually die as a result of surgery, at least 16 will die of cancer, and possibly 8 will survive five years (that is, 33 per cent of the resected group).

Judging by our experience and that of many of the authors whose work has been mentioned here, the average survival time after diagnosis of the 75 inoperable patients will be from three to six months. A small group of biologically favorable or radiosensitive cases (perhaps 10 per cent of the inoperable group) will show relatively longer survival, amounting in a few instances to several years. The chance of such increased survival is augmented by moderate-dose radiotherapy to the tumor and regional nodes. Even when survival time is not prolonged, the patient is usually made more comfortable by this treatment.

Duration of signs or symptoms, or the histologic type of tumor, do not reliably indicate the type of radiotherapeutic response. Indeed, patients with signs or symptoms of long duration tend to have a better chance of survival than those with symptoms of short duration.

In view of the short average survival time of patients with inoperable bronchogenic carcinoma, the questions arise: "Should these patients be subjected to radiotherapy at all?" "Would they not be more comfortable with simple medical measures?" On the basis of our experience, the following answer seems warranted: Most cases will benefit at least psychologically from judicious radiotherapy; in many, symptoms will be relieved; in a few, survival will be increased.

The survival time of a given individual patient cannot be reliably predicted. If he has symptoms produced by the cancer, he stands a good chance of being made more comfortable (both physically and mentally) by judicious radiotherapy, with an average of three months increased *survival*. It is of the utmost importance that he not be told in advance by his well-intentioned surgeon or personal physician that he will "get sick," have a "skin reaction," or "develop nausea, anorexia, and vomiting." An average person thus forewarned is almost sure to acquire all these symptoms under radiation exposure, even with a thick lead filter in place. On the other hand, if reassured that he will have a few or no side-effects, and if dosage is correctly graduated, he will probably tolerate adequate dosage with only transient disturbance and epidermitis. Symptomatic pulmonary fibrosis will rarely develop.

SUMMARY AND CONCLUSIONS

Radiotherapy in moderately heavy dosage (about 3,000 r tumor dose in four weeks or less) has a useful place in the palliative treatment of bronchogenic carcinoma. In heavy dosage (about 5,000 r tumor dose in four to five weeks), it is occasionally curative.

In a series of 122 cases of bronchogenic carcinoma (81 hospital cases and 41 private cases) treated by roentgen therapy alone, the average survival time after treatment was 6.2 months, the range being from one to sixty months. This average survival time was about three months longer than the average in a series of untreated cases.

Relief of symptoms for a period of weeks or months was obtained in approximately two-thirds of the treated cases, but marked improvement developed in only about 20 per cent of the patients.

Results were slightly better in patients with anaplastic tumors than in those with squamous-cell growths. The response to radiotherapy, however, was not predictable on histologic grounds; some of the well-differentiated squamous-cell lesions responded better than some of the anaplastic tumors.

Judging from the reports of megavoltage and betatron therapy to date, the results of orthovoltage therapy (200 to 250 kv) for bronchial cancer, using the technic outlined in this paper, are of about the same order of effectiveness.

These facts suggest that greater use should be made of generally available orthovoltage roentgen therapy in the care and treatment of inoperable bronchogenic carcinoma today.

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SUMARIO

Los Resultados de la Radioterapia del Cáncer Bronquial

La radioterapia a dosis moderadamente intensas (dosis tumor de unos 3,000 r en cuatro semanas o menos) ocupa un puesto útil en el tratamiento paliativo del cáncer broncógeno. A dosis intensas (dosis tumor de unos 5,000 r en cuatro a cinco semanas), resulta de cuando en cuando curativa.

En una serie de 122 casos de carcinoma broncógeno (81 casos hospitalizados y 41 particulares) tratados con la roentgenoterapia sola, el tiempo medio de sobrevivencia después del tratamiento fué de 6.2 meses, variando de uno a sesenta meses. Este tiempo medio de sobrevivencia fué unos tres meses más largo que en una serie de casos no tratados.

Obtúvose alivio de los síntomas durante un período de semanas o meses aproximadamente en dos terceras partes de los casos tratados, pero no apareció mejoría notable más que aproximadamente en 20 por ciento de los enfermos.

Los resultados fueron ligeramente mejores en los que tenían tumores anaplásicos que en los que tenían neoplasias escamocelulares. Sin embargo, la respuesta a la radioterapia no era predecible a base histológica.

A juzgar por las comunicaciones relativas a la terapéutica con megavoltaje y betatrones hasta la fecha, los resultados de la terapéutica de ortovoltaje (200 a 250 kv) para el cáncer bronquial, con la técnica bosquejada en este trabajo, alcanzan más o menos el mismo orden de eficacia.

Estos datos sugieren que debe darse mayor empleo hoy día a la roentgenoterapia de ortovoltaje en el tratamiento del carcinoma broncógeno inoperable.

Comparative Evaluation of Radioactive Colloidal Gold and Nitrogen Mustard in the Treatment of Serous Effusions of Neoplastic Origin[1]

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SINCE ITS INTRODUCTION by Müller in 1949, intracavitary radioactive colloidal gold therapy for carcinomatous effusions has become an almost universally accepted mode of treatment. A substantial body of literature (1–12) attests to the fact that this isotope can be expected to control the production of neoplastic effusions in 50 to 70 per cent of all cases. Most authors have agreed that it is most effective when the primary neoplasm originates in the ovary or breast.

Those who have worked with colloidal Au^{198} realize, however, that there are certain disadvantages inherent in its use: (*a*) the treatment is rather costly to the patient; (*b*) the short half-life and local unavailability necessitate careful planning and sometimes entail considerable delay in treatment; (*c*) the amount of radioactivity involved dictates certain precautions against exposure of nursing personnel which militate against optimum nursing care for the patient; (*d*) even with the best apparatus currently available for instillation, there is a distinct radiation hazard to persons administering this treatment.

Several authors (13–17) have called attention to nitrogen mustard (HN2) as an agent which is also effective in the control of malignant effusions. Since nitrogen mustard is much less expensive than radioactive colloidal gold, and since no radiation hazard is implicit in its use, it is the purpose of this paper to compare the efficacy of mustard and radioactive gold therapy, with a few observations concerning the use of the two in combination.

METHOD OF NITROGEN MUSTARD THERAPY

Immediately prior to the instillation of HN2 the patient is given Seconal and Thorazine. In cases in which there are pleural or peritoneal effusions of cancerous origin, nitrogen mustard is administered in a single injection of 0.4 mg. per kilogram of body weight, in 50 to 100 c.c. of sterile normal saline. If an excessive volume of fluid is present at the time of the therapeutic tap, all but a small amount is removed. A free flow of fluid must be present before instillation of HN2 in order that sufficient remain to insure dissemination of the mustard and to guard against the introduction of the substance subcutaneously or into a loculated pocket, where it might cause local tissue damage and necrosis. Mustard is instilled intraperitoneally through a small rubber catheter inserted through the paracentesis trocar, and in cases of pleural involvement through the thoracentesis needle. For pericardial effusion, a dose of 0.2 mg. per kilogram of body weight is generally employed.

Following administration of HN2 the patient's position is changed every five to ten minutes for a period of one hour, as is done in the radioactive colloidal gold therapy routine, to insure uniform distribution throughout the involved serous cavity. On the day following instillation of nitrogen mustard, paracentesis is again performed and as much fluid and free mustard as possible are removed. The patient must be followed closely both clinically and radiologically to guard against sudden accumulation of fluid, which has been known to occur in colloidal gold therapy as well.

Side-effects of nitrogen mustard therapy include nausea and vomiting and mild

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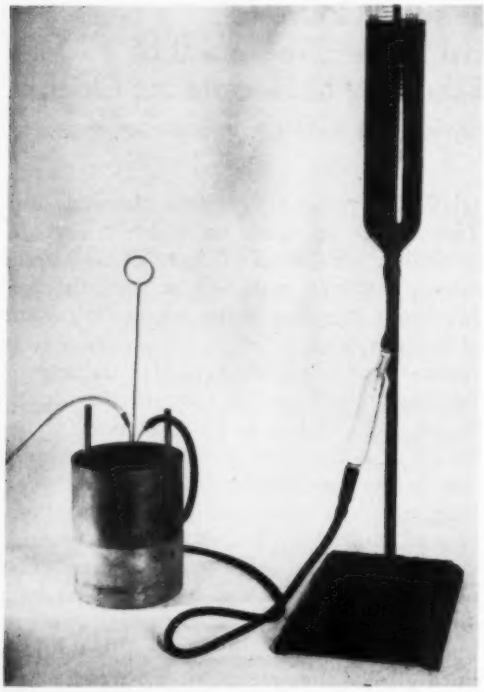

Fig. 1. The apparatus used at Western Reserve University for the instillation of radioactive colloidal gold. The gold stock bottle is in place in the lead shield and a double needle is inserted through its rubber cap by means of the long handle depicted. A burette is connected to the right hand needle and the left hand needle is connected to the trocar by disposable plastic tubing.

depression of the hematopoietic system. In no case was serious depression of blood-forming organs encountered with the doses described above.

METHOD OF RADIOACTIVE COLLOIDAL GOLD THERAPY

The method followed in the administration of radioactive colloidal gold is the same as that used in most other institutions at this time. The apparatus is shown in Figure 1, with the gold stock bottle in position in the shielding lead container. A double needle is inserted through the rubber cap of the bottle, the longer arm being connected to a reservoir of sterile normal saline by polyethylene tubing, and the shorter arm connected to the trocar, in place in the patient, in a similar fashion. After instillation, the patient is required to follow the routine of movement outlined above for nitrogen mustard.

TABLE I: RESULTS IN 22 CASES OF SEROUS THORACIC EFFUSION OF NEOPLASTIC ORIGIN, TREATED WITH RADIOACTIVE COLLOIDAL GOLD

Origin	Improved	Not Improved
Ovary	9	5
Breast	2	1
Lymphoma	1	0
Other	3	1
TOTAL	15	7

TABLE II: RESULTS IN 38 CASES OF ASCITES OF MALIGNANT ORIGIN, TREATED WITH RADIOACTIVE COLLOIDAL GOLD

Origin	Improved	Not Improved
Ovary	16	9
Breast	0	1
Lymphoma	1	0
Other	5	6
TOTAL	22	16

RESULTS

Tables I and II show the results obtained in the treatment of the first 60 patients in whom radioactive colloidal Au^{198} was employed. If no fluid accumulated within one month after treatment, or if only one further tap was required, the result was considered good and the patient was listed as improved. If there was no difference in the rate of fluid formation, if more than one additional thoracentesis was required for control of fluid formation, or if death occurred within one month after gold therapy, the patient was recorded as not improved. It was felt that those with a survival period of less than one month had not been observed for a significant period. It should be noted that many of the poor results obtained in the use of radioactive colloidal gold are listed as such because the patient was terminally ill at the time of treatment and died shortly thereafter. In general, a good result was achieved in 60 per cent of all patients treated, the best results being obtained when the primary tumors were of breast or ovarian origin.

In 40 patients receiving nitrogen mustard (Tables III and IV) the same system of grading the effects of treatment was fol-

TABLE III: RESULTS IN 30 CASES OF NEOPLASTIC EFFUSION OF THE PLEURAL CAVITY, TREATED WITH NITROGEN MUSTARD

Origin	Improved	Not Improved
Ovary	4	0
Breast	8	3
Lymphoma	3	3
Other	3	6
TOTAL	18	12

TABLE IV: RESULTS IN 10 CASES OF MALIGNANT ASCITES, TREATED WITH NITROGEN MUSTARD

Origin	Improved	Not Improved
Ovary	6	1
Breast	0	0
Lymphoma	0	0
Other	1	2
TOTAL	7	3

lowed, and results were comparable. Once again, it is apparent that breast or ovarian primary tumors produce disseminated metastases which are most sensitive to therapy, and again it will be noted that many of those cases placed in the category of failure are so classified because of short survival.

Table V shows the results in a group of 12 cases in which combined nitrogen mustard and colloidal gold therapy was attempted. In general, both materials were given within one week, the mustard being administered first. A two- to three-day interval between treatments was thought to be advisable, in case sudden or massive re-accumulation of fluid occurred. The series is small and it is felt that no significant conclusion can be drawn from it, though the results of the combined therapy appear to be comparable to those obtained with either agent alone. In 1 case, pericardial effusion produced a tamponade of such severity that marsupialization of the pericardium had been considered prior to rigorous combined therapy. While before treatment the patient had been bedfast and orthopneic, he was subsequently able to return home and was restored to fairly full activity in spite of the disability imposed by his primary disease, lung cancer. In several instances, the primary neoplasm had responded neither to gold nor mustard therapy separately, and sometimes had failed to respond to deep x-ray therapy as well.

TABLE V: RESULTS IN 12 CASES IN WHICH COMBINED THERAPY WITH RADIOACTIVE COLLOIDAL GOLD AND NITROGEN MUSTARD WAS ATTEMPTED

Origin	Site of Effusion	Improved	Not Improved
Ovary	Peritoneal	3	4
	Pleural	1	0
Breast	Peritoneal	0	0
	Pleural	1	0
Lymphoma	Peritoneal	0	0
	Pleural	0	0
Other	Pericardial	1	0
	Pleural	2	0
TOTAL		8	4

DISCUSSION

Nitrogen mustard directly instilled into malignant effusions appears to be of the same order of effectiveness as radioactive colloidal gold. Mustard has several advantages over radioactive gold: (*a*) it is easier and simpler to administer, no special facilities being required for its use; (*b*) it is almost universally available and, while the use of gold is confined to larger institutions with facilities for handling of large quantities of radioactive material, nitrogen mustard therapy may be carried on in the smallest hospital. Side effects may be controlled by appropriate medication and are no deterrent to treatment by HN2. For office or home use, however, it probably ought to be employed only with great caution,

If nitrogen mustard proves ineffective, subsequent treatment with radioactive colloidal gold may be beneficial.

It is apparent that direct instillation of nitrogen mustard into malignant effusions is effective against types of malignant tumors which ordinarily do not respond to the intravenous administration of the drug. Presumably the efficacy of intracavitary therapy is due to high local concentrations in direct contact with malignant tumor implants on serosal surfaces. Such a high local concentration is hardly obtainable by the intravenous route.

The results obtained with nitrogen mustard in the management of serous effusions of neoplastic origin have been so

encouraging that it has become routine in this institution to employ mustard first and gold only as a second method of attack. It has not yet been proved that the combined form of treatment has any additional advantage.

SUMMARY

1. Intracavitary instillation of nitrogen mustard for palliation in cases of profound effusions of neoplastic origin seems to yield results comparable to those obtained with radioactive colloidal gold.

2. The use of HN2 has several advantages over radioactive gold. It is easier to administer, it is more generally available, it is less expensive to the patient and presents no radiation hazard either to nursing personnel or to those administering the treatment.

3. In certain cases one substance may be successful where the other has failed. It has not been proved that a combined form of therapy, involving the use of both materials, gives better results than are obtained with either used alone.

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SUMARIO

Valuación Comparativa del Oro Coloidal Radioactivo y de la Mostaza Nitrogenada en el Tratamiento de los Derrames Serosos de Origen Neoplásico

La instilación intracavitaria de mostaza nitrogenada para paliación en casos de derrames profundos de origen neoplásico parece rendir resultados comparables a los obtenidos con el oro coloidal radiactivo.

El uso de la mostaza nitrogenada posee varias ventajas, comparada con el oro radioactivo. Es más fácil administrarla, es obtenible más generalmente, es menos costosa y no entraña riesgo irradiatorio para los que administran el tratamiento.

En ciertos casos, una substancia puede dar resultado, en tanto que la otra ha fracasado. No se ha demostrado que una forma combinada de terapéutica, comprendiendo el empleo de ambas, dé mejores resultados que los obtenidos con una u otra por sí solas.

The Roentgen Findings in Gastric Leiomyomas and Leiomyosarcomas[1]

JAMES G. DAVIS, M.D., and DAVID B. ADAMS, M.D.

AMONG BENIGN tumors of the stomach leiomyoma ranks second in incidence, being exceeded only by adenomatous polyps. Meissner (22) discovered 23 leiomyomas in a careful study of 50 stomachs chosen at random at autopsy. In three series of benign gastric tumors, the incidence has been reported as 36.6 per cent, 39.9 per cent, and 60 per cent, respectively (2, 3, 8). In a series of 711 gastric resections (28), leiomyomas made up 0.43 per cent of the cases. Rieniets (29) reported the incidence of gastric leiomyomas to be 16 per cent, and of gastric leiomyosarcomas 6 per cent, in 200 consecutive autopsies.

Leiomyosarcomas are said to form about 10 per cent of all gastric sarcomas (31). Of 30 smooth-muscle tumors of the stomach, Golden and Stout (11) found 65 per cent to be benign and 35 per cent malignant.

Accurate differentiation between leiomyoma and leiomyosarcoma by clinical observation, roentgenography, gastroscopy, or direct visualization at surgery, without histologic examination, is not always possible. Melnick (23) reported a case of histologically benign leiomyoma of the stomach with liver metastases, which suggests that even microscopic differentiation is difficult.

Nine proved cases, 2 leiomyomas and 7 leiomyosarcomas, form the basis of the present study.

CLINICAL FEATURES

No characteristic age or sex predilection of gastric leiomyomas and leiomyosarcomas has been observed. Our cases were all in men, with an age range from thirty-eight to seventy-six.

The patient may be asymptomatic. Hemorrhage in the form of hematemesis or melena is a common sign, and symptoms of anemia, such as weakness, fatigue, malaise, headache, or dizziness, are often observed. Pseudo-ulcer symptoms, as epigastric pain, burning, nausea, vomiting, or anorexia, are next in order of frequency. Weight loss usually is not more than 15 pounds.

Gastric acidity findings are not constant. In a few cases, a mass is palpable. Rarely, symptoms and signs of peritonitis may occur secondary to perforation of the tumor into the peritoneal cavity. Liver metastases and, infrequently, pulmonary or peritoneal metastases are found in conjunction with leiomyosarcomas.

PATHOLOGY

Gastric leiomyomas and leiomyosarcomas are extramucosal tumors which arise from the smooth muscle in the stomach wall. The former are composed microscopically of interlacing, irregularly arranged smooth-muscle fiber bands, usually with evidence of adult differentiation (Fig. 4C). In leiomyosarcomas, anaplastic cells with multiple mitoses, hyperchromatism, and a tendency toward round or ovoid nuclei, rather than those of spindle shape, are observed.

Degenerative changes overlying mucosal ulcerations are common. Calcification may occur and in rare instances is visualized roentgenographically as a calcified tumor (14).

CASE REPORTS

CASE I: D. E. B., a 56-year-old white male, was admitted to the hospital on Oct. 5, 1951, with a one-

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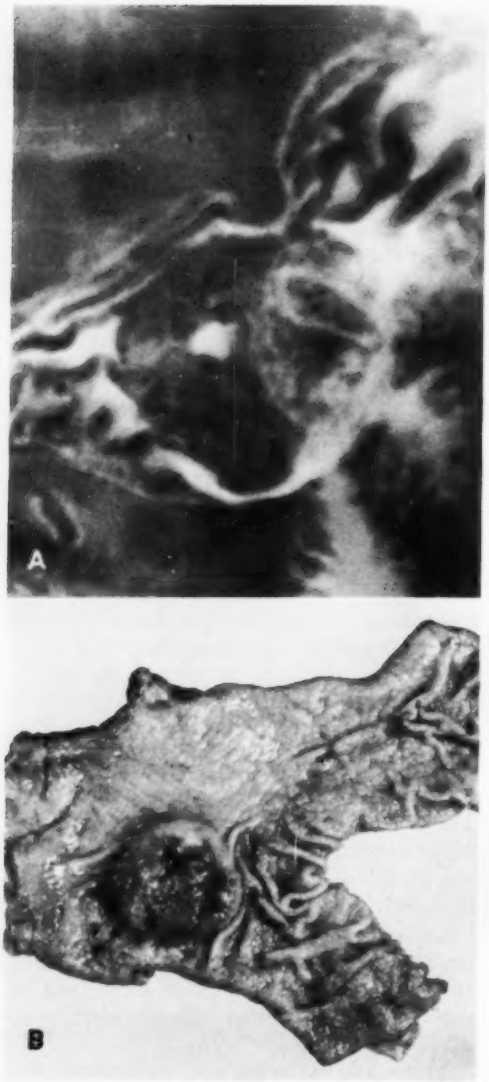

Fig. 1. Case I. A. Classical intramural-extramucosal leiomyosarcoma with mucosal ulceration. B. Gross surgical specimen showing the tumor on the posterior wall of the pars media.

day history of tarry bowel movements, headache, and weakness. There was no weight loss, and no abdominal mass was palpable. Hemoglobin was 5.8 grams; red blood count 2,200,000. Gastric acidity was normal. Stools were positive for occult blood. The roentgenologic impression (Fig. 1A) was leiomyoma or leiomyosarcoma. At a Billroth I resection, Nov. 1, 1951, an intramural tumor measuring 4 × 3.5 × 2.5 cm. was found on the posterior wall of the pars media (Fig. 1B). Two mucosal ulcerations were present. *Pathological diagnosis:* Leiomyosarcoma.

The patient was last seen on March 21, 1955, with no evidence of recurrence.

CASE II: H. E., a 76-year-old white male, was admitted on May 23, 1952, with generalized abdominal pain and melena of unknown duration. Weight loss was not recorded. No mass was palpable. Hemoglobin was 8.6 grams; red blood count 3,600,000. Gastric acidity was normal. Stools were positive for occult blood. Roentgen examination suggested possible diverticulum of the stomach and duodenal ulcer, but, in retrospect, a tumor in the cardia with central ulceration is apparent. At surgery, on June 3, an intramural mass, measuring 5 × 6 cm., was found on the lesser curvature aspect of the gastric cardia, with mucosal ulceration. *Pathological diagnosis:* Leiomyosarcoma.

The patient died on June 12, 1952.

CASE III: P. C. G., a 51-year-old white male, was admitted on June 2, 1945, complaining of dizziness, dyspnea, and "fluttering of the heart" (duration not given). No gastrointestinal symptoms were elicited, except for dark stools. There was no record

Fig. 2. Case III. Intramural-extramucosal leiomyosarcoma with mucosal ulceration.

of weight loss. A mass was palpable in the epigastrium. Hemoglobin was 4.5 grams; red blood count 2,800,000. Gastric acidity was low. Stools were positive for occult blood. X-ray studies suggested a neoplasm or "bezoar" (Fig. 2). Partial gastrectomy was done on July 8 and a 6-cm. intramural mass was found in the body of the stomach near the lesser curvature, with two mucosal ulcerations. *Pathological diagnosis:* Leiomyosarcoma.

When the patient was last seen, in November 1954, there was no evidence of recurrence.

CASE IV: R. W. H., a 38-year-old white male, was admitted on Nov. 21, 1952, with a three-day history of tarry stools and hematemesis. There was no weight loss. No mass was palpable. Hemoglobin was 5.8 grams; red blood count 1,700,000. Gastric acidity was normal. Stools were positive for

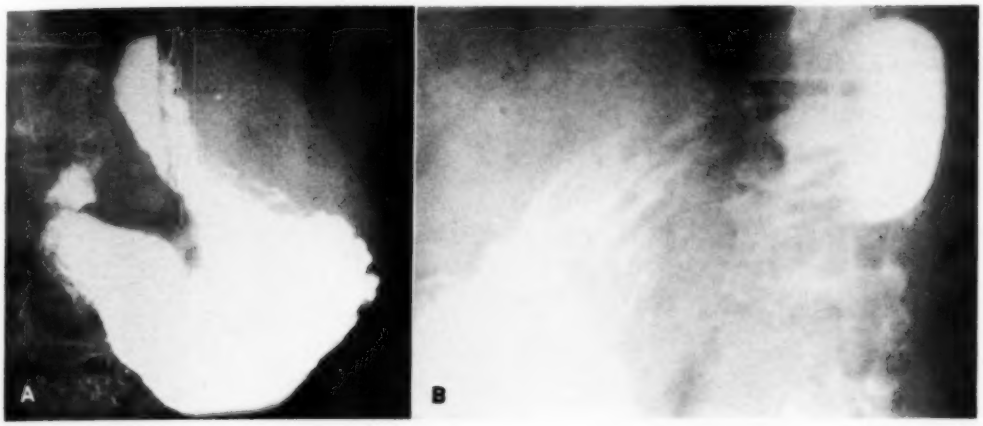

Fig. 3. Case V. A. Exogastric leiomyosarcoma of greater curvature. B. Intact mucosa stretched over the exogastric mass.

occult blood. The roentgen impression was leiomyoma or leiomyosarcoma. A subtotal gastric resection was done on Dec. 30, and an intramural tumor, measuring 3 × 4 cm., was found on the posterior wall of the pars media, with mucosal ulceration. *Pathological diagnosis:* Leiomyosarcoma.

The patient was last seen on March 15, 1955, with no evidence of recurrence.

CASE V: S. C., a 54-year-old white male, was admitted on Feb. 18, 1952, with a three-day history of left upper abdominal pain radiating into the left shoulder. A 12-pound weight loss was recorded. A mass, palpable in the upper abdomen, was believed by most examiners to be a large spleen. Hemoglobin was 12.6 grams; red blood count 4,000,000. No gastric analysis was performed. Stools were negative for occult blood. The roentgen impression (Fig. 3, A and B) was of a left upper quadrant lesion, splenomegaly, pancreatic cyst, and gastric leiomyoma or leiomyosarcoma being considered in the differential diagnosis. At a gastric sleeve resection on March 21, an exogastric tumor measuring 16 × 14 × 6.5 cm. was found attached to the greater curvature of the pars media, extending into the greater omentum; there was no evidence of mucosal ulceration. *Pathological diagnosis:* Leiomyosarcoma.

Widespread intra-abdominal metastases were discovered at re-exploration on Dec. 10, 1953. The patient was last seen in October 1954, with pain, nausea, and vomiting.

CASE VI: M. M., a 60-year-old white male, was admitted on Oct. 10, 1951, with a six-months history of left upper quadrant abdominal pain, gradual increase in the size of the abdomen, and an 11-pound weight loss. A 7-cm. mass was palpable in the upper abdomen. Hemoglobin was 13.0 grams; red blood count 4,100,000. No gastric analysis was performed. Stools were positive for occult blood. Roentgen studies suggested an extrinsic mass, probably splenomegaly. Total gastrectomy was done on Nov. 20. An exogastric mass, measuring 15 × 13 × 10 cm., was found attached to the greater curvature of the pars media, extending to the hilus of the spleen. No mucosal ulcerations were observed. *Pathological diagnosis:* Leiomyosarcoma.

When the patient was last seen on Nov. 10, 1954, there was no evidence of recurrence.

CASE VII: D. D. L., a 41-year-old Negro male, was admitted on Feb. 8, 1952, with a ten-year history of known achalasia. Aside from dysphagia, no gastrointestinal complaints were elicited. Weight loss was not recorded. No mass was palpable. Hemoglobin was 7.6 grams; red blood count 2,000,000. No gastric analysis was performed. Stools were not examined for occult blood. Roentgenograms demonstrated achalasia and a small prepyloric polypoid mass, with a differential diagnosis of polyp, aberrant pancreatic nodule, or leiomyoma. A Heller operation was done on March 3, and the polypoid mass was removed through a second incision. A submucosal tumor, measuring 3 × 1 × 1 cm., was found in the prepyloric region but there were no mucosal ulcerations. *Surgical diagnosis:* Leiomyoma. *Pathological diagnosis:* Fragments of smooth muscle tissue.

The patient was last seen on April 11, 1952, with no evidence of recurrence.

CASE VIII: T. C. W., a 60-year-old white male, was admitted on Jan. 11, 1950, with a fifteen-year history of recurrent nausea and vomiting. The patient had lost 25 pounds in an eight-month period. No mass was palpable. Hemoglobin was 17.0 gm.; red blood count 5,000,000. Gastric acidity was normal. There was no record of occult blood in the stool. The x-ray impression (Fig. 4, A and B) was

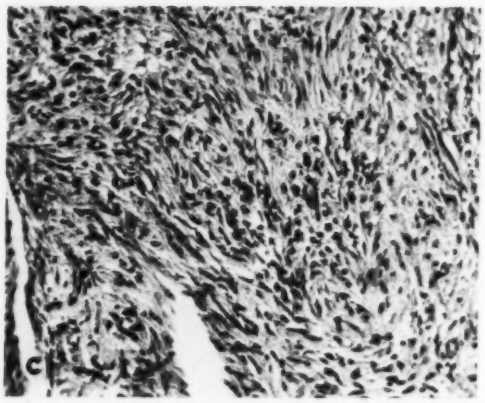

Fig. 4. Case VIII. A. Spot-film showing polyp-like leiomyoma in the prepylorus. B. Partial prolapse of leiomyoma into duodenal bulb. C. Photomicrograph showing leiomyoma.

of a prepyloric mass lesion, probably benign, although the possibility of malignancy was not excluded. Local surgical excision of the nodule was performed on Feb. 2. It measured 3.2 × 1.7 cm. and involved the anterior wall of the prepyloric area, with no evidence of mucosal ulcerations. *Pathological diagnosis:* Leiomyoma (Fig. 4C).

No follow-up is recorded.

CASE IX: J. H., a 76-year-old white male, was admitted April 7, 1952 with a one-year history of anemia which had not responded to iron therapy. He complained of postprandial pain in the left lower chest, relieved by soda. A 6-pound weight loss was recorded. A mass was palpable in the upper abdomen, in the standing position only. Hemoglobin was 7.6 grams; red blood count 3,800,000. No gastric analysis was done. Stools were positive for occult blood. The roentgenographic impression (Fig. 5A) was of fungating carcinoma. A segmental resection was done on May 7. A pedunculated tumor, measuring 8 × 8 × 3.5 cm. was found, connected to the mid-body of the stomach by a 2 × 5-cm. pedicle (Fig. 5B). No mucosal ulcerations were present. *Pathological diagnosis:* Leiomyosarcoma.

The patient died on May 1, 1954, from a carcinoma of the prostate. Autopsy revealed no recurrence of the leiomyosarcoma.

RADIOGRAPHIC FINDINGS

The 9 cases of this report fall into 4 distinct radiological categories:

1. Intramural-extramucosal tumors with or without mucosal ulceration.
2. Exogastric tumors.
3. Polyp-like tumors.
4. Fungoid intraluminal tumors.

Cases I through IV represent the intramural-extramucosal type of lesion. In these instances, a sharply outlined mass effaces the overlying mucosa, with an abrupt transition to normal mucosa at the tumor margin. All of the cases of this type in our series showed one or more mucosal ulcerations. Mobility of the stomach was normal, and peristalsis was

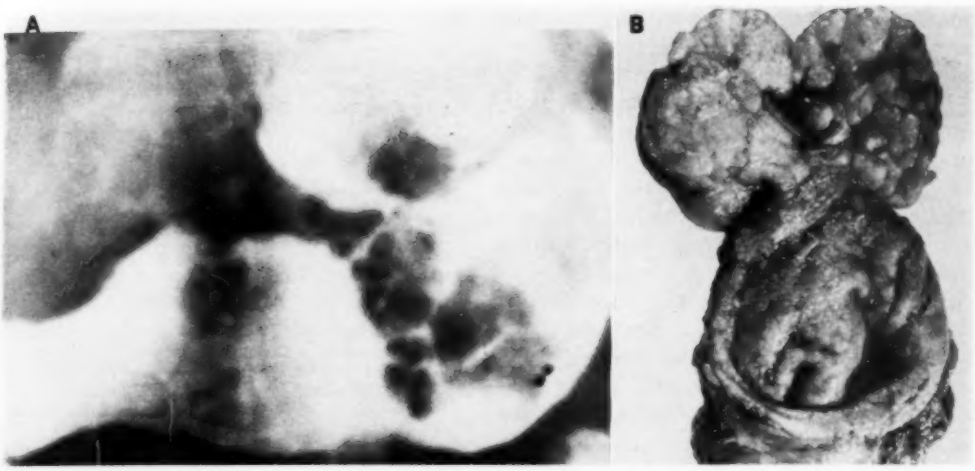

Fig. 5. Case IX. A. Pedunculated leiomyosarcoma simulating polypoid carcinoma. B. Gross surgical specimen showing pedunculated tumor.

not disturbed except at the tumor site. These findings are fairly characteristic for either leiomyoma or leiomyosarcoma. Other intramural tumors, however, may present the same appearance. Both benign and malignant tumors of all the histologic cell types found in the stomach wall must be considered in the differential diagnosis. Lowman *et al.* (18) and Preiss (27) have reported gastric adenocarcinomas with the same radiologic picture.

Exogastric tumors are represented by Cases V and VI. Although these neoplasms arise from the stomach wall, growth proclivity is largely outside the stomach proper. They must attain considerable size before they become manifest by pressure effect. An abdominal scout film may reveal a soft-tissue mass. In our cases, displacement of the stomach by extrinsic pressure was evident. The splenic flexure of the colon was depressed in 1 instance. As in other extrinsic masses, the mucosa was stretched over the tumor. No mucosal ulcerations were found. The stomach and the tumor could not be separated at fluoroscopy. Other masses in the left upper abdomen may simulate this appearance as a result of extrinsic pressure on the stomach. Splenomegaly was regarded as a diagnostic possibility in both Case V and Case VI. Masses arising from the liver, pancreas, kidney, adrenal, omentum, mesentery, and aorta may produce similar findings.

Cases VII and VIII are of the polyp-like type. Although they arise as intramural tumors, their small size and their submucosal location may mimic the roentgen appearance of mucosal polyp. The only mucosal alteration is local effacement at the tumor site; no mucosal ulcerations were seen. Mobility and peristalsis were unaltered. The actual occurrence of partial intussusception of a prepyloric tumor into the duodenal bulb is shown in Case VIII (Fig. 4, A and B). Differential diagnosis should include adenomatous polyps, aberrant pancreatic nodules, and hamartomas.

In Case IX the radiographic appearance was that of a fungoid carcinoma, with irregular filling defects in the lumen of the stomach; this picture is explained by the presence of a lobulated intraluminal mass upon a broad pedicle. Since the tumor was too high in the stomach lumen for adequate palpation, the presence of a mobile tumor on a pedicle was not appreciated.

COMMENTS

Gastric leiomyomas and leiomyosarcomas have no single characteristic radiographic appearance. Intramural extra-

mucosal tumors with overlying mucosal ulceration present the most distinctive picture.

Other tumors of this group simulate extrinsic mass lesions, polypoid gastric tumors, or even fungoid carcinoma. Prompt surgical removal and histologic study is the only reliable method of determining precisely the type of tumor with which one is dealing.

In general, the prognosis for leiomyomas, if removed, is excellent. Since leiomyosarcomas may metastasize, the prognosis should be guarded. As a rule, the outlook is more favorable than in adenocarcinomas of the stomach.

CONCLUSIONS

1. The clinical and pathologic features of gastric leiomyomas and leiomyosarcomas are described.

2. Nine proved cases are presented, with analysis of radiographic findings.

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SUMARIO

Los Hallazgos Roentgenológicos en los Leyomiomas y Leyomiosarcomas Gástricos

Descríbense aquí los leyomiomas y leyomiosarcomas gástricos con referencia a sus características clínicas y anatomopatológicas. Se presentan 9 casos comprobados. Los síntomas comprenden hematemesis o melena, anemia, dolor epigástrico, náuseas, vómitos y anorexia, aunque en algunos casos, el enfermo se muestra asintomático. La pérdida de peso no suele exceder de unos 7 kilogramos.

Los 9 casos presentados corresponden a cuatro distintas categorías radiológicas: (1) tumores intraparietales-extramucosos con o sin ulceración de la mucosa; (2) tumores exogástricos; (3) tumores polipoideos; (4) tumores intraluminales fungoideos. Los leyomiomas y leyomiosarcomas gástricos no poseen típico aspecto radiográfico. Los tumores intraparietales-extramucosos con ulceración sobreyacente de la mucosa presentan el cuadro más distintivo; las demás formas pueden simular lesiones tumorosas extrínsecas, tumores gástricos polipoideos y hasta carcinoma fungoideo. La rápida extirpación quirúrgica es el único método seguro para la determinación precisa de la naturaleza del tumor.

En general, el pronóstico de los leyomiomas es excelente, si se extirpan. Como los leyomiosarcomas pueden metastatizar, el pronóstico es reservado, aunque la perspectiva es generalmente más favorable que en los adenocarcinomas del estómago.

Experiences with the Upright Fluoroscopic Spot-Film Examination of the Gallbladder[1]

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THE PURPOSE OF this brief paper is to describe further experiences (1) with the upright fluoroscopic spot-film examination of the gallbladder and to compare it with other procedures.

Cholecystographic technics fall into four groups:

1. Examination with the patient horizontal and an overhead tube. *Today such examination cannot be called acceptable.*

2. Examination of the upright patient with an overhead tube, taking advantage of the effect of gravity with stratification. This represents a real advance, but with a number of shortcomings: Aiming is difficult; intestinal gas is frequently superimposed upon the gallbladder shadow; in certain body types the gallbladder is projected upon bony structures of the pelvis.

3. Examination of the patient in the right lateral decubitus with a horizontal ray, as described by Kirklin (2). This offers the gravitational advantages of the upright study, theoretically without the frequent superimposition of intestinal gas and bony structures. Without elaborate accessories, however, such as a table that can be rotated on its long axis, the gallbladder shadow actually *is* often obscured by gas and bone.

4. Spot-filming with a fine-focus (1.0 mm. square, or less) rotating anode tube beneath the table. This affords definite advantages over the previous technics. Radiography of the gallbladder with a spot-film device that does not have such a tube is, however, not to be advised. The stationary anode with larger focal spot will not allow the definition demanded for detecting lesions in the range of 1 mm.

It is strongly urged that the gallbladder and gastrointestinal examinations be combined. We have several cases on file in which one of the two examinations was done repeatedly over the years; only when the other was finally done was a positive diagnosis obtained and the difficulty relieved. We are convinced that a clinical differential diagnosis between gallbladder disease and gastric ulcer is often impossible, especially in women.

Our technic is as follows: A high-fat lunch the day before the examination aids in emptying the gallbladder of viscid contents which might interfere with the entrance of the fresh medium-containing bile. A preliminary scout film of the abdomen before taking the six tablets of Telepaque is certainly desirable, but the nature of our practice makes this difficult. After preliminary fluoroscopic examination of the thorax, the abdomen is scanned and the gallbladder shadow is then sought. Palpation with attendant movement of the viscera may help in demonstration of the less dense gallbladders. Spot-films are made with varying degrees of compression and rotation. Occasionally it may be necessary to cleanse the hepatic flexure with a 1.0 per cent tannic acid-water enema if a completely unobstructed view of the gallbladder cannot be obtained with any degree of rotation.

It must be emphasized that the most cephalic reaches of the gallbladder should be included in the fluoroscopic study. We have demonstrated a stone resting upon a proximal incomplete septum which would have been missed had only the more obvious dependent portion of the gallbladder been included on the film. (The density in the proximal segment can be increased by having the patient remain in the Trendelenburg position for several minutes before assuming the upright, but we fear that this might disturb the layering of mi-

[1] Accepted for publication in July 1955.

nute stones.) If the gallbladder lies within the pelvis, it will usually ascend on pressure with the examining hand below it.

If visualization is not satisfactory, a second dose of six tablets of Telepaque is given the same evening, and the examination is repeated the following morning. If at that time no definite gallbladder shadow is seen fluoroscopically, prone and oblique studies with the overhead tube are made in the hope of demonstrating stones and obtaining a shadow of minimal density. While we are aware of the disagreement concerning the value of the fatty meal, we feel that the primary purpose of this is to render calculi more visible (3) rather than to determine gallbladder contraction and filling of the common duct (other technics of greater constancy are available for the latter purpose and can be employed at a later date). Because of the high efficiency of the present technic, we have therefore dispensed with the routine fatty meal. Immediately after the gallbladder examination the technical factors are changed for the gastrointestinal series.

The choice of proper technical factors (voltage and milliampere-seconds) for the gallbladder examination is crucial. By and large it is not left to the technician. The radiologist, after some experience, can become quite expert in this. The "compressibility" of the abdomen is a real consideration in determining the factors. For example, marked "compressibility" can offset abdominal thickness, and minimal "compressibility," thinness. The lower voltage range is to be preferred, because the density of the gallbladder shadow and contrast with surrounding parts are less marked than with barium. With our equipment, an "average" patient would require 70 kv, 0.2 seconds, 200 ma. Fine coning is, of course, necessary. A grid is not used and, indeed, tends to obscure fine filling defects.

CASE REPORTS

The following patients all presented symptoms that were compatible with gallbladder disease.

Fig. 1. Case I. Small constant defect on upright spot-film. *Diagnosis:* Inflammatory papillomatosis.

CASE I: A 58-year-old white woman. A constant small filling defect (4) was demonstrated on the pressure spot-film (Fig. 1). (This study, made with our early stationary anode tube several years ago, would not be technically acceptable today.) The shadow was clearly seen, also, with the patient prone, but not in the lateral decubitus position with a horizontal ray. The opened gallbladder was found to contain four minute yellow formations fixed by tenuous stalks. These were to become detached during transit to the pathologist some fifty miles away.

Pathologic diagnosis: Chronic cholecystitis with focal cholesterolosis and polyp formation.

Comment: The superiority of the upright spot-film over the lateral decubitus view is clearly demonstrated in this case. The pathologic findings indicate also the need for clarification concerning the terms "polyp" and "papilloma." These are merely descriptive designations, with no implication as to the nature of the condition. It is probably not possible at this time to make a roentgenologic differential diagnosis between inflammatory and neoplastic polypoid or papillomatous lesions in the gallbladder. That severance of the tenuous stalks which fix these focal cholesterol formations to the mucosa plays a role in the pathogenesis of at least some stones is an attractive hypothesis, but unproved.

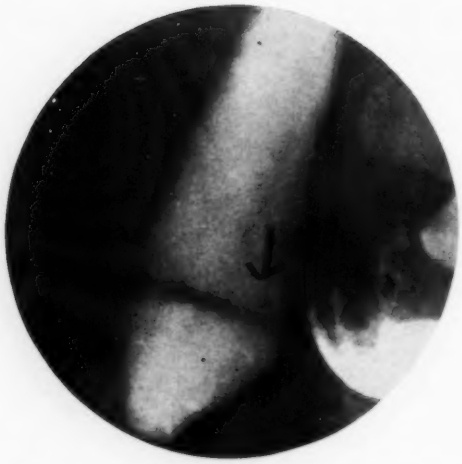
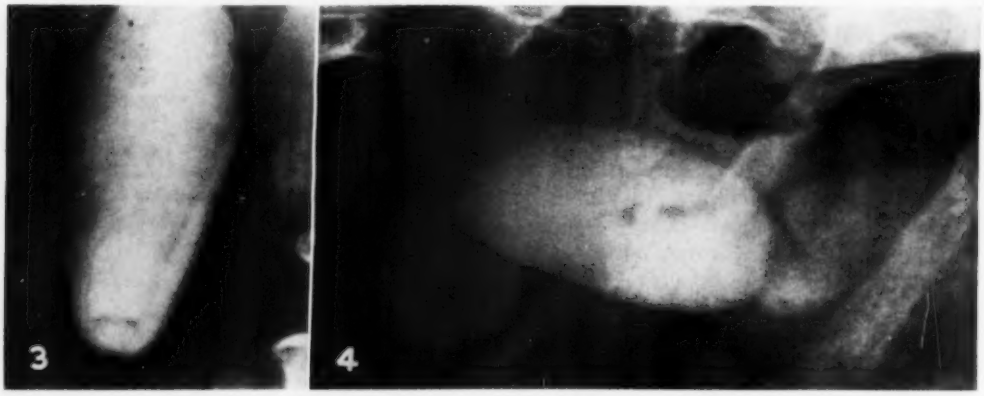


Fig. 2. Case II. Small constant defect above septum.

Comment: Case III again illustrates the superiority of the upright spot-film over the right lateral decubitus view and even indicates some possible dangers inherent in the latter projection. That the duodenum, at least if it contains fluid, can be superimposed upon the gallbladder in right lateral decubitus can easily be demonstrated after barium ingestion. The same is true for the hepatic flexure after a barium enema.

CASE IV: A 20-year-old white woman. Figure 5, an upright spot-film, shows an extremely fine layering effect. In studies made some minutes later, after ingestion of barium, the layering was much less distinct and in changed position. This change might have some relation to minute variations in degree of compression, to the ingestion of the barium,



Figs. 3 and 4. Case III. Layering effect in upright film (Fig. 3). Pseudo-layering effect of intestinal gas on right lateral decubitus study (Fig. 4).

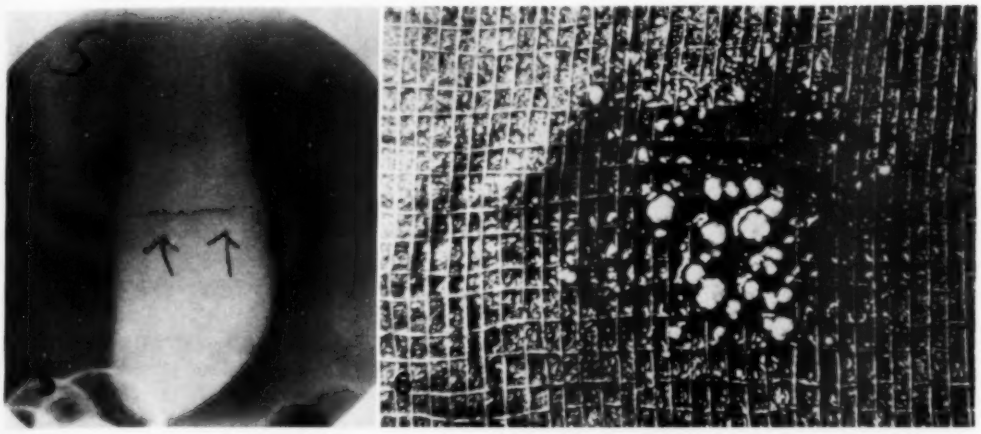
CASE II: A 39-year-old white woman. A minute constant filling defect was demonstrated on the upright spot-film (Fig. 2), reproducible at will but not apparent with the patient prone or in right lateral decubitus. *Roentgenologic diagnosis:* Polypoid lesion, nature undetermined.

Pathologic diagnosis: Cholesterol polyp.

CASE III: A 42-year-old white woman. The upright spot-film (Fig. 3) shows distinct layering, while the right lateral decubitus view (Fig. 4) presents a pseudo-layering effect, probably due to gas in the duodenum. This could certainly mislead the unwary. Repeat views at short intervals revealed a changing pattern of the pseudo-layering. Studies made with the patient prone were entirely inconclusive. The opened gallbladder contained 6 stones from 1 to 2 mm. in diameter.

or to modifications of the bile density incident to the manipulations of the gastrointestinal series. It is clear, however, that the size of the calculi approaches the limit of macroscopic radiologic visibility. They could be shown on no other projection, including the right lateral decubitus. Upright spot-films made several minutes after the second set no longer demonstrated any filling defect, attesting to the exquisite balance required among all possible factors for detection of these minute stones. Figure 6 is a photograph of the stones following straining of the bile through gauze.

Comment: This case illustrates the ability of this technic to detect minute defects, and the ease with which these are lost; also, its superiority over examination with



Figs. 5 and 6. Case IV. Fig. 5. Fine layering effect approaching macroscopic radiographic visibility. Fig. 6. Minute stones and granules strained from bile. Fig. 6 is highly magnified. The background against which the stones are shown is ordinary surgical gauze, with meshes of about 0.5 mm.

the patient prone or in right lateral decubitus.

CASE V: A white woman, 18 years old, with a family history of hemolytic icterus. Only a shadow of sub-optimal concentration was seen during the first gallbladder examination, and a diagnosis of stones could not be made from any projection. An additional six tablets of Telepaque were given and on the following morning the gallbladder shadow was of excellent density. Prone and right lateral decubitus studies were normal. Figure 7, an upright spot-film, clearly shows several small shadows at the bottom of the gallbladder. Studies made several minutes later, with increased closure of the fluoroscopic diaphragm in an attempt further to increase the definition of the filling defects, no longer definitely demonstrated these shadows. It is apparent that, the technical factors remaining the same, the variables of compression and coning, and possibly some changes in the bile itself, are responsible for this change, again attesting to the capriciousness that can characterize the demonstration of these defects.

Comment: The gallbladder examination should not end with a diagnosis of sub-optimal concentration. An additional dose may demonstrate stones. Superiority of the upright spot-film examination over the prone and lateral decubitus is again illustrated.

Fig. 7. Case V. Small filling defects at bottom of gallbladder.

SUMMARY AND CONCLUSIONS

1. In the writer's hands the upright fluoroscopic spot-film study of the contrast-containing gallbladder, with varying degrees of compression and rotation, proved simpler in execution and more effective in demonstrating minute filling defects than the prone and right lateral decubitus positions. While it is true that no compression, rotation, or immobilization devices were used for the right lateral decubitus studies, the gallbladder shadow in this projection was often marred by superimposed intestinal gas and ribs. Further, this projection does not permit graded compres-

sion, which is felt to be essential for the demonstration of smaller filling defects.

2. Gallbladder examination does not lend itself to assembly-line methods, and the meticulous care which it demands pays more than ample dividends. That the demonstration of minute filling defects can be so erratic, depending on several variables, would suggest the advisability of the oft-repeated examination in the patient with a typical clinical picture of gallbladder colic, but with a "negative" initial study.

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SUMARIO

Resultados del Examen de la Vesícula Biliar con Radiografías Instantáneas Roentgenoscópicas Verticales

Al A. le resultó el estudio de la vesícula biliar llena de substancia de contraste con radiografías instantáneas roentgenoscópicas en posición erecta, con varios grados de compresión y rotación, más sencillo en su ejecución y más eficaz para descubrir nichos minúsculos que la observación en posiciones de decúbito prono y lateral derecho. Aunque es un hecho que no se utilizan artefactos de compresión, rotación o inmovilización en los estudios en decúbito lateral derecho, la imagen de la vesícula biliar en esa proyección fué a menudo desfigurada por la sobreposición de gas intestinal y de las costillas. Además, esa proyección no permite la compresión graduada que parece ser indispensable para el descubrimiento de los nichos más pequeños.

El examen de la vesícula biliar no se presta para los métodos puramente rutinarios y la meticulosidad que exige rinde dividendos por demás generosos. El hecho de que el descubrimiento de nichos minúsculos puede ser tan problemático, conformándose a distintas variables, sugiere la conveniencia de repetir a menudo el examen en el enfermo que presenta un típico cuadro clínico de cólico biliar, pero cuyo estudio inicial resulta "negativo."

Achalasia: Anatomy of the Cardia as It Relates to the Regional Pathophysiology[1]

Lieut. Col. EDDY D. PALMER, M.C., U.S.A.

THE REGION OF the esophagogastric junction is at the moment an active investigational focus for both clinician and physiologist. An interesting aspect of current study of this area is the lag of anatomic understanding far behind physiologic understanding. There is a need to find out, especially, the relation of the anatomic to the physiologic esophagogastric junction. Proper conclusions can be drawn only from observations made on the living organ. The anatomy of the region is too dynamic to make its features evident in the dead specimen.

Achalasia is one of those diseases whose clinical study may permit better understanding of normal regional anatomy and physiology. Here, especially, study of dead organs is not informative. Inspection of the opened esophagus and stomach at the autopsy of a patient with achalasia gives little or no information regarding the anatomic limits of the segment which was narrow during life. Furthermore, study of the anatomy of the cardia in achalasia must be carried out within the lumen of the organ, since the location of the esophagogastric mucosal junction, as defined by the line marking the change in epithelial type, is believed to be paramount in identification of the precise site of narrowing.

The present study was made to determine where the line of esophagogastric mucosal junction lies in achalasia in relationship to the abnormal organ configurations as they are visualized roentgenologically. Previous studies have shown that normally gastric mucosa extends up into the "abdominal esophagus," making it, by definition, part of the stomach (8), and that the esophagogastric mucosal junction normally may migrate a few centimeters toward and away from the brink of the stomach sac, independent of contractions of the regional muscularis propria (9).

Fig. 1. Achalasia in a patient with direct hiatus hernia. On esophagoscopic examination the region of the cardia appeared normal, without stricture, esophagitis, or unusual resistance to passage of the instrument.

MATERIAL AND METHOD

Six adult males, aged from twenty to seventy-six years, with a clinical, roentgenologic, and esophagoscopic diagnosis of achalasia were studied. Four were given the Mecholyl test (6) and all responded in a positive fashion.

One of the patients had a fixed direct hiatus hernia in addition to achalasia (Fig. 1). This is the only instance of such a combination that the writer has encountered, and the association is believed to be very rare. In this instance it was, of course, necessary to exclude the possibility that the megaesophagus was due to stricture secondary to the hernia. This was

[1] From the Gastroenterology Service, Walter Reed Army Hospital, Washington, D. C. Accepted for publication in July 1955.

Fig. 2. Clip (arrow) in position on esophagogastric mucosal junction, showing that the esophageal dilatation extended down to the stomach.

believed to have been done with assurance on the basis of serial esophagoscopic examinations. In addition, although the first fluoroscopic examination during Mecholyl administration showed little response, a repeat study demonstrated swift contraction of the esophagus, with relaxation of the esophagogastric junctional segment.

The plan called for esophagoscopy of these patients, who had already been thoroughly studied, biopsy of the esophagogastric mucosal junction, attachment of a silver brain clip to the biopsy site, and then examination with contrast roentgenography in order to determine the relation of the clip to organ configuration. As easy as the technic usually is in the normal subject, the problem of selecting the proper biopsy site is a difficult one in the presence of achalasia. Because of the frequency of stasis esophagitis in these patients, it is almost always difficult to locate with assurance the line of epithelial junction, even with telescopic magnification and under optimum endoscopic conditions. Identification of the organ to which the clip is attached usually must be made entirely in retrospect, on the basis of the tissue obtained at biopsy. For the present study, if the specimen did not include the actual junction, the effort was useless. In one case in which the first clip had been placed on gastric mucosa, a second attempt resulted in attachment to esophageal mucosa; however, the two clips were close enough to permit satisfactory identification of the line of mucosal junction. Altogether 21 patients with achalasia were studied by this technic, but in only 6 were the clips accurately enough placed to justify conclusions.

OBSERVATIONS

The presence of the clips made it clearer than is ordinarily evident during fluoros-

Fig. 3. In this case the mucosal junction lies between the two clips. The patient has just ingested 250 ml. of barium suspension and the barium column has fallen to the hydrostatic level governed by the tone of the muscles at the cardia. The vestibule has been forced open a little, so that now a bit of the stomach is taking part in the dilatation.

copy that respiratory motion and the weight of the barium-suspension column in the dilated portion of the esophagus have a considerable influence over the length of the narrow segment in achalasia. From time to time this segment was infringed upon by extension of the dilatation part way into it. Its length was thus decreased as much as 50 per cent immediately following rapid ingestion of

250 ml. of barium suspension, but less through the phases of forced inspiration and expiration. It was clear that extrinsic pressure influences in the region of the diaphragmatic hiatus had no control over this passive pliability.

When the patients were examined in the upright position, breathing quietly, and the barium column had fallen to a

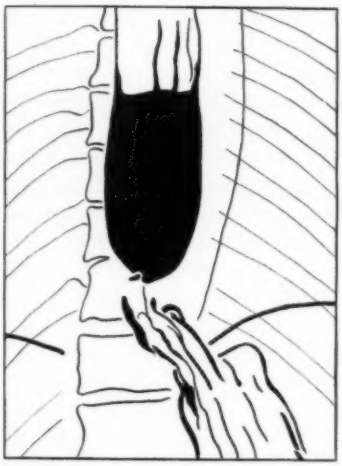

Fig. 4. Roentgen findings in the patient with hiatus hernia in addition to achalasia. Biopsy specimen from the clip-site included the mucosal junction.

rather static level in the dilated esophagus, the clip marking the most orad limit of the gastric mucosa was invariably found at the caudad portion of the dilatation, just as the channel became narrowest (Figs. 2 and 3). No spontaneous migration of the clip in relation to the narrowing was ever observed as long as the height of the barium column remained relatively unchanged and the respirations continued quiet. The observations in the patient with hiatus hernia in addition to achalasia were entirely similar to those in the other cases (Figs. 4 and 5).

DISCUSSION

That the esophageal ampulla normally exhibits deglutitory dynamics which differ significantly from those of the body of the organ was recognized many years ago.

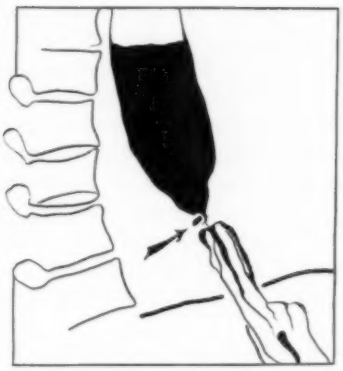

Fig. 5. Also representing the roentgen findings in the case of associated achalasia and hiatus hernia.

Although one would not like to suggest that the major physiologic secrets of the esophageal body and ampulla are out, these two regions are well understood as compared to the anatomy and physiology of the segment which joins the ampulla to the stomach proper, *i.e.*, the "abdominal esophagus." This has rather recently been designated the gastroesophageal vestibule, because it is limited by two physiologic token sphincters, the inferior esophageal sphincter above and the constrictor cardiae below. All or a part of it, or part of it from time to time, is normally lined with gastric mucosa continuous with that of the stomach proper (8). Thus, the vestibule, a segment 2 to 3 cm. long, seems to be part esophagus, part stomach.

Whatever the vestibule is anatomically, it does not act like either esophagus or stomach, but exhibits a characteristic motor function of its own, as Ingelfinger, Kramer, and Sanchez (4) have shown. Its unique physiology seems to be of little clinical importance except in achalasia. If the vagus nerves are stimulated at the time of myotomy for early or mild achalasia, the body of the esophagus contracts but the region of the vestibule dilates (5). Typical achalasia can be produced by cervical vagotomy and has been an occasional complication of transthoracic vagotomy. Experimentally, postvagotomy

achalasia can be prevented by section of the sympathetic supply (2), but in man sympathectomy has proved unsuccessful because of aberrant sympathetic tracts and because of the rather free mixture of cholinergic and adrenergic fibers in some autonomic tracts. In fact, the function of the normal vestibule and esophagus is not altered at all by thoracic sympathectomy, and the role of the sympathetics in normal esophageal motility is poorly understood (11).

Ingelfinger, Kramer and Sanchez (4, 6) have demonstrated that the vestibule and body of the esophagus also react inversely to cholinergic stimuli, pharmacologically applied. Autonomic imbalance, however, must apparently already exist, as it does in achalasia, before these pharmacologic reactions can be brought out (3). Mecholyl in achalasia causes relaxation of the vestibule but contraction of the esophageal body. On the other hand, Mecholyl produces little or no change in the activity of the normal esophagus, and it appears fair to say that achalasia is characterized by unique hypersensitivity to this drug. As might be expected, the anticholinergic, methantheline bromide (Banthine), interrupts the disorganized phasic contractions of the circular muscle of the body of the esophagus in achalasia (11), but no antagonistic effect is noted in the vestibule.

It seems probable that cardiospasm and achalasia should be considered separate entities, although there is disagreement on this point. Cardiospasm implies persistent spasm of the circular muscle of the cardia, with esophageal dilatation which is entirely secondary to the obstruction. It is apparently rare. Scott (10) has described complete and permanent spontaneous cure of apparent typical cardiospasm following resection of a gastric ulcer. He found this type of megaesophagus, which may disappear upon elimination of irritative upper gastrointestinal disease, to be distinguishable clinically from true achalasia because it is relieved temporarily by spinal anesthesia. Achalasia is much commoner, is a generalized disorder of the motility of the entire esophagus, is apparently due to intimate parasympathetic denervation, and is said to show no response to spinal anesthesia. In the cardia the disease is characterized by inability of the circular muscle to relax beyond its normal resting tone, perhaps partly because it receives no activating impulse from the diseased body of the esophagus. The muscle is not in spasm and exhibits little resistance to dilatation.

Roentgenologically it is clear that in achalasia the segment of narrowing between the dilated esophagus and the stomach corresponds to the vestibule. That the narrow area is more than a thin annular orifice was pointed out years ago by the pathologists. In 11 of 14 specimens from achalasia patients, Moore (7) found a long segment of narrowing situated wholly below the level of the diaphragm; this he spoke of as the "cardiac canal." Walton (12) and Bull (1), too, emphasized the considerable linear extent —2 to 4 cm.—of the undilated tube which courses below the diaphragm before the stomach is joined. Bull's "broad physiologic sphincter" seems to have designated the segment now known as the vestibule.

The present study brings out a parallelism between the anatomy and the pathophysiology of the esophageal body and the vestibule in achalasia. Achalasia is a generalized disease of the esophagus in which the vestibule appears to play no active part. The segment toward which therapy by dilatation or surgery must necessarily be directed—the vestibule—is, paradoxically, the potentially normal segment. This segment is lined with gastric mucosa and must be considered part of the stomach. Where the esophagus ends anatomically, the primary abnormal physiology of achalasia stops.

SUMMARY AND CONCLUSION

1. The transesophagoscopic biopsy-and-clip technic in 6 patients with achalasia, including one with an associated hiatus hernia, showed that in each gastric mucosa extended upward to line the nar-

row segment (gastroesophageal vestibule) as far as the brink of the dilated esophagus.

2. A brief review is presented of current understanding of the pathophysiology in achalasia, which indicates that the vestibule behaves quite differently than the body of the esophagus in this disease. The vestibule is capable of functioning normally but does not, probably because it receives no activating stimulus from the esophagus.

3. It is concluded that in achalasia all of the esophagus, as defined anatomically according to mucosal type, is diseased, and that the potentially normal narrow segment below the area of dilatation is part of the stomach.

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SUMARIO

Acalasia: La Anatomía del Cardias en su Relación con la Patofisiología Regional

Estos estudios se hicieron en 6 enfermos que tenían acalasia del esófago, comprendiendo uno con hernia asociada del hiato, para determinar la localización exacta de la unión esofagogástrica en relación con las configuraciones anómalas del órgano en dicha enfermedad. Después de la esofagoscopia, se obtuvo por biopsia un ejemplar de la unión esofagogástrica y se adhirió una grapa de plata al sitio de la biopsia. Luego se determinó radiográficamente la relación de la grapa al estómago y al esófago. En todos los casos, se observó que la mucosa gástrica se extendía hacia arriba hasta el borde del dilatado esófago, recubriendo el segmento estenosado, que correspondía al llamado vestíbulo gastroesofágico.

Las observaciones de los AA., junto con un repaso de los conceptos actuales de la patofisiología de la acalasia, indican que el comportamiento del vestíbulo y del esófago es bastante distinto. El primero es capaz de funcionar normalmente y se ve probablemente impedido de hacerlo únicamente por no recibir ningún estímulo activador del esófago.

Dedúcese que la acalasia es una afección generalizada del esófago, definida anatómicamente conforme al patrón de la mucosa, y que el segmento potencialmente estrechado forma parte del estómago y no desempeña papel activo en la enfermedad.

Gastric Lipoma

Case Report[1]

JAMES V. ROGERS, Jr., M.D.,[2] and ELIZABETH K. ADAMS, M.D.[3]

SINCE GASTRIC lipoma is rarely diagnosed preoperatively, the following case is considered of interest. Skorneck published a report (3) of a similar example in 1952.

CASE REPORT

A 50-year-old white female was admitted to Emory University Hospital two weeks following the discovery of a gastric tumor on roentgen examination by her physician. The initial gastrointestinal series was performed because of epigastric pain of eight months duration, which was unrelated to meals. Upon admission to the hospital, no significant abnormalities were discovered on physical examination or on routine laboratory tests. A gastrointestinal series disclosed a large mass in the antrum of the stomach, arising along the greater curvature and measuring about 7 × 9 cm. Within the mass were two large ulcerations, about 1.5 and 2.5 cm. in diameter, respectively. The mass itself was definitely less dense than the adjacent tissues, indicating that it was made up of fatty tissue (Figs. 1 and 2). It was believed to be a submucosal tumor, probably a lipoma or liposarcoma.

A subtotal gastrectomy and anterior gastrojejunostomy were performed. Examination of the specimen revealed an ovoid mass, 8 × 6 cm., of soft but slightly elastic consistency. Two ulcer craters measuring 0.8 and 0.7 cm. in diameter, respectively, penetrated to a depth of 8 mm. The mucosa appeared to be edematous over the tumor area, but was not remarkable elsewhere. The tumor was well encapsulated, and easy to shell out, except for two areas of fibrous attachment in the immediate vicinity of the mucosal ulcerations. It was entirely intramural, being covered by 1 to 3 mm. of mucosa and 2 to 3 mm. of the muscular wall along the serosal surface. Microscopic examination confirmed the diagnosis of lipoma of the stomach with mucosal ulcerations. Areas of fat necrosis and fibrosis were also seen.

DISCUSSION

About 5 per cent of the gastric tumors diagnosed on roentgen examination are benign. The figure based on autopsy diagnoses is slightly higher, since many of the benign lesions are asymptomatic. About 2 per cent or less of all benign gastric tumors are lipomas, a little over 100 cases having been reported. These tumors may be sessile or pedunculated. In the latter instance, they may initiate intussusception or intermittent intestinal obstruction by a ball-valve mechanism. Although the majority of these lipomas are submucosal, they may be predominantly intramural or subserosal. Gastric lipomas are, in rare instances, multiple; they are occasionally associated with lipomas elsewhere. The tumors are seldom large enough to be palpable, generally averaging 4 to 5 cm. in diameter. The antrum is the usual site of involvement. Approximately a third of all lipomas of the stomach have overlying ulcerations.

Accurate preoperative diagnosis of the histologic type of a benign gastric tumor is unusual. It has been occasionally reported following gastroscopy with aspiration of tumor material. Gastric analysis is usually non-contributory. Despite many pitfalls in the radiographic diagnosis of benign gastric neoplasms, accurate identification of the type of tumor is occasionally possible with the aid of certain characteristic roentgen signs.

Palmer (2), in 1951, presented an excellent review of benign intramural tumors of the stomach, outlining the characteristics of each. Culver and Dobrak (1) in 1950 reported a case of submucous gastric lipoma. A gliding motion beneath the mucosa indicated its submucosal position; it is doubtful, however, that this characteristic is specific for lipoma. Skorneck, as mentioned above, presented a case of gastric lipoma similar to the one reported here, in which preoperative diagnosis was

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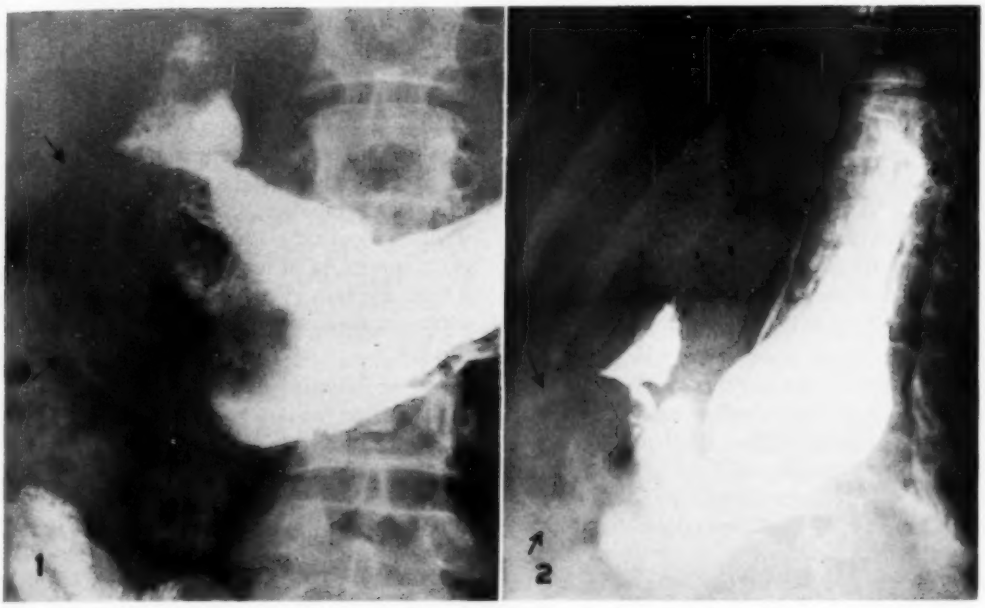

Fig. 1. Postero-anterior roentgenogram showing large fatty tumor of gastric antrum. The ulcers, seen at fluoroscopy and demonstrated on spot films, are not well visualized in this view.
Fig. 2. Oblique roentgenogram demonstrating the relative radiolucency of the fatty tumor.

made by roentgen demonstration of the fatty content of the tumor. In both instances liposarcoma was included in the differential diagnosis, though no report of liposarcoma of the stomach was discovered in the literature. It seems unlikely that small lipomas contain sufficient fat for roentgen identification; only in large tumors will this characteristic be demonstrable. Palmer found that 8 cases of dermoid cyst of the stomach had been recorded, in some of which the lesions were quite large. It is suspected that, unless tooth or bone formation occurs in these fatty cysts, they may be indistinguishable radiographically from lipomatous tumors.

CONCLUSION

A single case of gastric lipoma is presented, in which the radiographic findings suggested the proper diagnosis. Submucosal gastric tumors in which fatty tissues can be demonstrated radiographically probably represent gastric lipoma or, infrequently, dermoid cysts. Gastric liposarcoma is apparently of rare occurrence, since the authors were unable to find any example of the condition in a review of the literature.

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Lipoma Gástrico: Presentación de un Caso

Se presenta un caso de lipoma gástrico en el que el descubrimiento roentgenológico de tejido adiposo sugirió el diagnóstico acertado. El tumor era submucoso, con ulceración sobreyacente. En general, se considera improbable que los lipomas pequeños contengan suficiente grasa para la identificación radiográfica; solamente en los tumores grandes cabe observar esta característica. Parece que los tumores de la submucosa gástrica en que puede descubrirse tejido adiposo representan probablemente lipomas gástricos o, en casos raros, quistes dermoideos. En el caso descrito ahora, se consideró liposarcoma gástrico en el diagnóstico diferencial, aunque la dolencia es rara, no habiéndose encontrado mención de ella en la literatura.

Agglomeration of Barium Sulfate and Roentgen Visualization of the Gastric Mucosa[1]

P. K. KNOEFEL, M.D., L. A. DAVIS, M.D., and L. A. PILLA, M.D.

IN PREVIOUS investigations of the factors influencing visualization of the gastric mucosa (1–3), we have considered the nature of the opaque medium and the constitution of the subject. After developing a procedure for evaluation of the results of attempted visualization in which we had some confidence, we studied the influence of particle size in barium sulfate, the use of organic compounds of iodine rather than barium, and the role of constitutional factors in the subject, including gastric function. It was found that, with barium sulfate, increase of particle size beyond a certain point gave poorer results, but that reduction of particle size below this value conferred no advantage. Great variation occurred from person to person, the constitutional factors showing the best correlation with mucosal demonstration being the volume of the gastric juice and its mucin content. The greater these values the poorer was the visualization. Barium sulfate was found to be more influenced in this way than were the organic iodine compounds, which could be used safely and effectively in the alimentary tract.

Secretions of the alimentary tract have been shown by Frazer *et al.* (4) to interfere with roentgen visualization of the small intestine by barium sulfate, and to cause its flocculation both *in vitro* and *in vivo*. We have investigated this phenomenon, have attempted to associate it with the composition of the gastric juice, have evaluated its importance in influencing mucosal visualization, and have sought means of its prevention.

Since the phenomenon is one of flocculation or agglomeration of $BaSO_4$ into large particles which sediment rapidly, we have used for its quantitative evaluation a method derived from that given in the U. S. Pharmacopeia (5) for testing particle size. In a 50-ml. glass-stoppered cylinder with 0- and 50-ml. marks close to 115 mm. apart is placed 5 gm. of $BaSO_4$ U.S.P. that has been passed through a No. 60 sieve. Water and other materials are added to bring the volume to 50 ml. The contents are mixed by inversion every two seconds for one minute and the cylinder is put on the table. The times at which the boundary of the descending $BaSO_4$ passes each 5-ml. mark are noted. These are plotted on co-ordinate paper and the maximum rate of sedimentation is estimated graphically. From the measurement of the cylinder, this result is converted to millimeters per second.

The results of this test can be striking, in that addition of gastric juice to give a 1:10 dilution may accelerate the sedimentation more than ten times. The phenomenon is believed to be one of adsorption of a constituent of the gastric juice by the particles of barium sulfate, since increasing the amount of added gastric juice increases the agglomeration until a maximum is reached, after which further additions have no effect. Also, gastric juice loses this agglomerating activity after treatment with $BaSO_4$. The responsible constituent is believed to be a mucoprotein, since the material which is removed by treatment with $BaSO_4$ is found to contain 1.9 mg. of glucose-equivalent reducing substance per milligram of nitrogen.

In an attempt to evaluate the importance of this agglomeration for roentgen visualization, the following study was made: In 10 subjects a tube was passed into the stomach, and aspiration and sampling of gastric contents were done as

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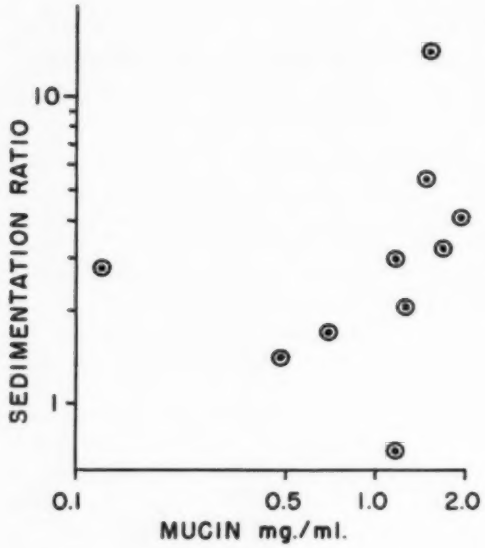

Fig. 1. Relation of sedimentation to mucin *in vitro*. *Abscissa:* Concentration of mucin in gastric contents. *Ordinate:* Ratio of rate of sedimentation of $BaSO_4$ in a 1:10 dilution of gastric contents to sedimentation in water.

reported earlier (2). $BaSO_4$ was then given and films made, which were rated 1 to 10 in order of excellence of mucosal visualization. The sample of gastric contents was studied for pH, mucin content (1, 2), and agglomerating activity for $BaSO_4$ *in vitro*. The results are shown in Table I and Figures 1 and 2.

Agglomeration of $BaSO_4$ has been reported (6) to be reduced, though not abolished, by addition of sodium carboxymethylcellulose. This action and that of other dispersing agents we have investigated both *in vitro* (Table II) and *in vivo* (Table III). The choice of agents has been determined largely by evidence of their safety for human consumption. The evaluation *in vivo* was made as before (1, 2). The films were drawn at random for independent evaluation by two radiologists who were unaware of the composition of the opaque medium, as were also those who administered it.

DISCUSSION

Human gastric contents have to a varying degree an agglomerating action on barium sulfate. This effect is apparently due to "mucoprotein," one of several poorly defined components of gastric juice (7). It is therefore not surprising that we have found less than perfect correlation between agglomeration and "mucin," as arbitrarily determined by us. Actually, an occasional sample of gastric contents will retard rather than accelerate the sedimentation of barium sulfate (Fig. 1). Our attempted correlation of mucosal visualization with mucin content and agglomeration indicates that these factors seem to be less important than volume of gastric contents alone (Fig. 2). However, the results with dispersing agents appear to support a belief that agglomeration interferes with mucosal visualization. For example, "Tween

TABLE I: STUDIES OF GASTRIC CONTENTS IN RELATION TO FILM QUALITY

Film Score*	Gastric Contents					
	Estimated Volume (ml.)	pH	Mucin Concentration (mg./ml.)	Mucin Amount (2) × (4)	Sedimentation Ratio†	Agglomeration (2) × (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	57	..	0.69	39	1.7	97
2	37	3.10	1.84	68	4.1	152
3	8	6.92	0.47	4	1.4	11
4	25	..	0.12	3	2.8	70
5	13	3.75	1.63	21	3.2	42
6	9	3.80	1.23	11	2.1	19
7	7	6.90	1.46	10	14.0	100
8	12	5.40	1.13	14	3.0	36
9	9	5.30	1.14	10	0.7	6
10	10	5.50	1.47	15	5.5	55

* 1 = worst, 10 = best.

† Ratio of sedimentation rate of $BaSO_4$ in a 1:10 dilution of gastric contents to sedimentation rate of $BaSO_4$ in water.

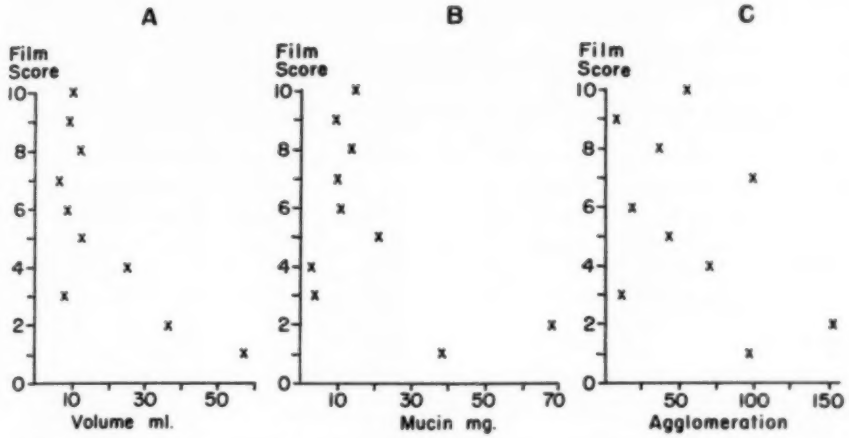

Fig. 2. Relation of mucosal visualization to properties of gastric contents. *Abscissa:* A, volume of gastric contents; B, amount of mucin in stomach; C, agglomerating activity of gastric contents. *Ordinate:* Film score (1, poorest; 10, best).

TABLE II: AGGLOMERATION OF $BaSO_4$ IN VITRO, WITH VARIOUS DISPERSING AGENTS

Substance	Concentration (%)	Sedimentation Rate (mm. per second)			
		$BaSO_4$ Alone	$BaSO_4$ + Adjuvant	$BaSO_4$ + Gastric Juice	$BaSO_4$ + Adjuvant Gastric Juice
Monoglycerides					
Myvatex 5-40	0.4	0.37	5.9	1.1	0.70
Myverol 18-00	0.4	0.40	0.28	1.4	0.53
Myverol 18-40	0.4	0.40	19.0	..	..
Myverol 18-85	0.4	0.40	6.0	..	..
Coconut	0.4	0.40	7.5	..	..
TEM AA-36	0.4	0.51	..	1.4	*
Polyoxyethylene Derivatives					
Tween 80	0.6	0.26	0.10	..	..
" "	1.0	..	..	0.38	0.33
Myrj 45	0.4	..	..	1.4	1.3
Alevaire	0.01	0.51	..	1.4	1.4
"	0.09	0.51	..	1.4	0.7
Cellulose Derivatives					
Methylcellulose	0.02	0.46	0.31	1.0	1.1
" "	0.06	0.46	0.30	2.8	1.9
" "	0.5	..	..	2.8	1.1
Na carboxymethylcellulose	0.1	..	†		†
Na cellulose sulfate	0.02	0.60	..	1.1	1.2
" " "	0.05	0.60	..	1.2	†
" " "	0.1	0.41	†	1.6	†
Lecithins					
Lecithin, soya	0.05	0.96	..	2.8	1.7
" "	0.1	0.96	1.5	2.8	0.89
Egg yolk, dried	0.15	0.96	..	2.8	1.4
" " " 0.15 per cent, egg white	0.05	0.96	..	2.8	1.2
Magnesium aluminum silicate					
"Veegum"	0.1	0.54	0.36	1.3	0.39
"	0.5	0.54	0	1.3	0.03

Note: Myverol products contain approximately 95 per cent of mixed monoglycerides. Type 18-00, made from hydrogenated lard, is about 73 per cent stearate; Type 18-40, made from prime steamed lard, is about 48 per cent oleate; and Type 18-85, made from cottonseed oil, is about 50 per cent linoleate. Myvatex 5-40 is a 1:1 blend of prime steamed lard and Myverol Type 18-40. Coconut, 48 per cent lauric acid monoglyceride. TEM AA-36, acetylated mono-glyceride tartrate. Tween 80, polyoxyethylene sorbitan mono-oleate. Myrj 45, polyoxyethylene stearate. "Alevaire" Winthrop-Stearns, oxyethylated tertiary octyl phenol polymer. Methylcellulose, "Cologel" Lily. Na carboxymethyl cellulose, "Carmethose" Ciba.

* No clear boundary; rapid sedimentation.

† The cellulose acids, when added to a suspension of $BaSO_4$, prevent sedimentation. When gastric juice is present, a large part of the $BaSO_4$ remains suspended so that no descending boundary can be seen, but subsequently a great part of the $BaSO_4$ can be seen to have fallen to the bottom of the cylinder.

TABLE III: ADJUVANTS AND VISUALIZATION OF MUCOSA

Sample	No. of Subjects	Films Read by	Score*				
			1	2	3	4	Average
Series 1							
No adjuvant	11	ELP	2	4	3	2	2.5
		LAD	2	5	2	2	2.4
Tween 80	11	ELP	10	1	0	0	1.1
		LAD	8	3	0	0	1.3
Methylcellulose	12	ELP	9	3	0	0	1.3
		LAD	7	5	0	0	1.4
Carboxymethylcellulose	10	ELP	0	2	5	3	3.1
		LAD	0	4	3	3	2.9
Cellulose sulfate	9	ELP	0	2	6	1	2.9
		LAD	0	3	2	4	3.1
Cellulose sulfate, "Micro" barium sulfate	10	ELP	2	6	2	0	2.0
		LAD	0	6	4	0	2.4
Lecithin	10	ELP	0	5	2	3	2.8
		LAD	2	2	3	3	2.7
Egg yolk	13	ELP	0	3	5	5	3.2
		LAD	1	4	4	4	2.8
Series 2							
Methylcellulose 1.5%	13		0	10	1	2	2.4
Carboxymethylcellulose 0.125%	7		0	5	2	0	2.3
Magnesium aluminum silicate 10%	10		6	3	1	0	1.5

Note: All observations but one were made with a 1:2 W/V suspension of a single sample of $BaSO_4$ U.S.P. The "Micro" $BaSO_4$ was that received from the Mallinckrodt Chemical Works and used in our previous study (1). In the first series, 1 ounce of the mixture was given and all adjuvants were in a concentration of 1.5 per cent. In the second series, 6 ounces of mixture was given.

* 1, poor visualization of mucosa; 2, fair; 3, good; 4, excellent.

80" *in vitro* is not effective in preventing agglomeration and, *in vivo*, gives poorer results than $BaSO_4$ alone. Also, methylcellulose is inferior both *in vitro* and *in vivo* to the cellulose derivatives with ionic groups (carboxymethylcellulose and cellulose sulfate). Lecithin and egg yolk both reduce agglomeration and improve visualization. "Veegum" provides an exception, in that it reduces agglomeration but gives poor visualization. It may be that the high viscosity of this mixture is an important factor.

It is of interest that the results with the "micro" $BaSO_4$ are inferior, since we had previously (1) found this to be true in the dog.

SUMMARY

Barium sulfate is agglomerated by gastric contents as a result of adsorption of mucoprotein. This agglomeration impairs roentgen visualization of the gastric mucosa but is not the chief factor in this respect.

Of various dispersing agents, several are found to reduce the agglomeration of barium sulfate by gastric contents and to improve its demonstration of the gastric mucosa.

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SUMARIO

Aglomeración de Sulfato de Bario y Visualización Roentgenológica de la Mucosa Gástrica

Se ha demostrado que el jugo gástrico produce aglomeración y sedimentación del sulfato de bario usado para la visualización de la mucosa gástrica. Este fenóneno parece ser de adsorción de la mucoproteína del jugo gástrico por las partículas del sulfato de bario. La aglomeración se redujo y la visualización mejoró al agregar carboximetilcelulosa de sodio al medio. Justiprécianse además otros dispersantes con respecto a su efecto sobre la aglomeración y la calidad de la radiografía.

Metastatic Vertebral Osteomyelitis Following Prostatic Surgery[1]

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SINCE BATSON'S (1) basic contribution concerning spread of disease and tumor by means of the vertebral system of veins, several cases of metastatic vertebral osteomyelitis have appeared in the literature. Some of these have been associated with or have appeared in the presence of urinary tract infection (4–6). A small but increasing number have been observed directly following prostatic surgery, apparently caused by the operative procedure (6–9). To our knowledge, only 8 cases of the latter type have been reported to date. Recent papers given at various meetings will, once published, add to the literature. It is to this small group that we wish to contribute 2 further cases. No attempt will be made at complete discussion of the condition, since it has been thoroughly presented elsewhere (6–9).

CASE I: L. R., an 87-year-old retired white male, underwent a transurethral prostatic resection in March 1954 for benign hypertrophy. Preoperative roentgenograms of the lumbar spine showed no unusual features. The patient was discharged on April 7, following an uneventful postoperative course. About two weeks later, acute pain developed in the lower back, and within a few days the patient was bedridden. Roentgen study revealed destruction of the opposing halves of the bodies of L-2 and L-3, with the articular cortices faintly visible (Fig. 1). On readmission to the hospital, physical examination showed spasm of the lumbar muscles and extreme tenderness over the spinous processes of L-2 and L-3. The patient was unable to stand because of pain. Neurological examination was negative. The temperature was normal, but the sedimentation rate was elevated to 1.2 mm. in a minute (normal regarded as 0.4 mm. in our laboratory). The white blood count was normal. *A. aerogenes* and *B. pyocyaneus* were cultured from the urine. No blood culture was obtained. The patient improved on bedrest and was symptom-free upon discharge, Aug. 2, except for pain on motion of the trunk, which was limited. The most recent films, Oct. 29, 1954, showed no essential change except for some increase in calcific bridging.

CASE II: W. Z., a 71-year-old white male, was first admitted to the hospital on June 7, 1954, for treatment of acute prostatitis. Following quiescence of this condition, a transurethral prostatectomy was performed on July 9, during which a small abscess was entered. *B. pyocyaneus*, *A. aerogenes*, and *E. coli* were cultured from the urine at this time. Preoperative roentgenograms of the dorsal spine were normal. While still in the hospital, the patient complained frequently of upper backache, first experienced on July 16. He was discharged on July 26 but re-entered the hospital about one week later with severe backache. Signs of cord compression at the D-4 level subsequently developed. Roentgenograms showed a destructive process of the opposing portions of D-4 and D-5 and narrowing of the interspace (Fig. 2). A paravertebral mass visualized at this level was thought to represent abscess formation. A laminectomy was performed on Aug. 4, and an epidural abscess was believed to be present but was not opened. At this time the white blood count and temperature were normal, but the sedimentation rate was elevated to 1.85 mm. in a minute.

The postoperative course was uneventful except for a short bout of chills and fever, during which a blood culture was positive for *A. aerogenes*. The signs of cord compression disappeared and only slight weakness of the right foot remained. The general condition improved and the patient was finally discharged in a plaster-of-Paris body shell on Dec. 4. The most recent films of the involved spine showed progression of the disease, with further collapse of the involved vertebrae. The general condition remains good.

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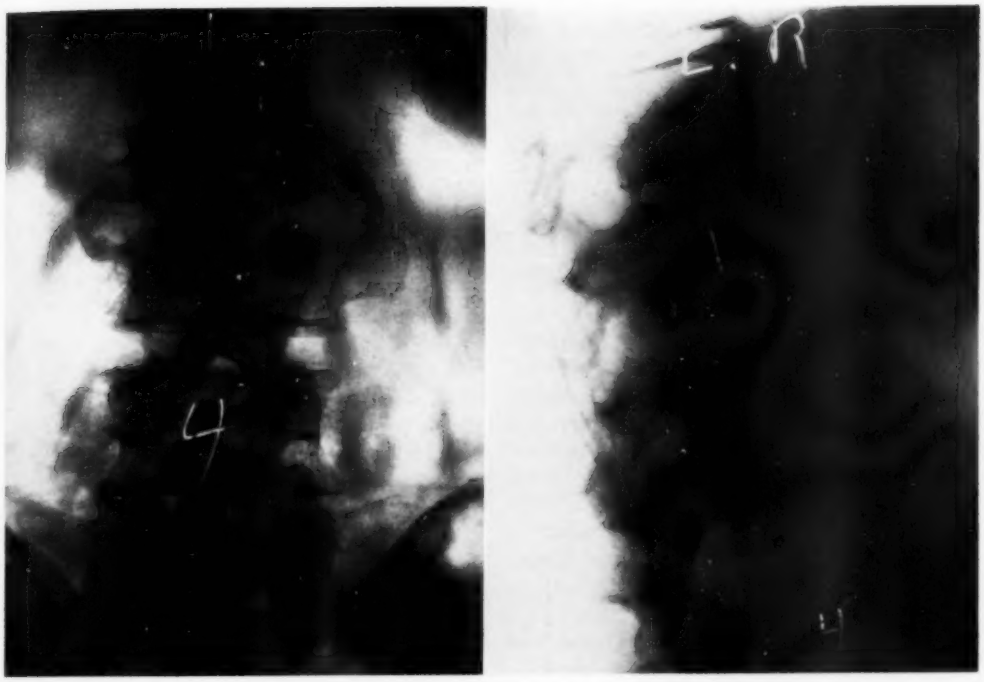

Fig. 1. Case I. Destruction of opposing portions of bodies of L-2 and L-3, with involvement of intervertebral disk. Moderate calcific bridging is present between the two vertebrae.

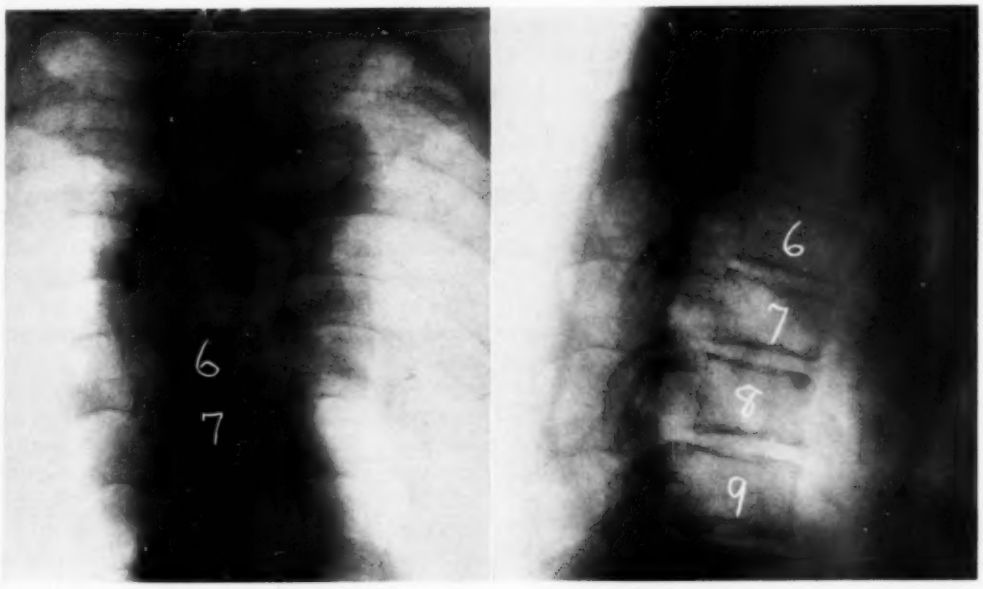

Fig. 2. Case II. Portion of dorsal spine showing destruction of opposing portions of bodies of D-4 and D-5 and intervertebral disk. A paravertebral soft-tissue mass is visible, representing abscess formation.

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SUMARIO

Osteomielitis Vertebral Metastática Consecutiva a Cirugía Prostática

En la literatura han aparecido varios casos de osteomielitis vertebral metastática, algunos de ellos asociados con infecciones del aparato urinario. Un número pequeño, pero creciente, de casos ha sido observado inmediatamente después de haberse ejecutado cirugía prostática, aparentemente causados por el procedimiento operatorio. En este estudio, se presentan 2 casos consecutivos a la prostatectomía.

Diabetic Charcot Joints[1]

JOHN G. BOLEN, M.D.

A RARE complication of diabetes mellitus is the production of neuropathic joint changes in the foot. Early descriptions of neuropathic or Charcot joints represented them as pathognomonic of syphilis, but similar findings have been reported in leprosy, peripheral nerve injury, syringomyelia, pyogenic soft-tissue infections following puncture wounds, and other infections secondary to trauma. Only 29 complete case reports of Charcot joints secondary to diabetic neuropathy could be found in the available medical literature. Of these, 17 are from a single institution (1).

The etiology of Charcot joints in diabetes mellitus remains controversial. Beidleman and Duncan (2) attributed tarsal Charcot-joint formation in patients with severe long-standing diabetes to (*a*) chronic impairment of the afferent pain and proprioceptor impulses as a result of diabetic neuritis with intact motor power in the extremity, and (*b*) repeated minor trauma to the affected joints. They described less pronounced changes in the metatarsals and phalanges as secondary to chronic infection in the adjacent soft tissues, and to arterial insufficiency resulting from arteriosclerosis of the endarteritis obliterans type. Jordan (3, 4) stated that the joint changes were of neuropathic origin but mentioned other theories, such as vitamin B complex deficiency with resulting peripheral neuritis, and impaired circulation caused by arteriosclerosis and aggravated by chronic soft-tissue infection. Bailey and Root (1) believed the etiology to be solely neuropathic. Normal dorsalis pedis pulsations were present in 14 of their 17 cases and, in view of the frequency of severe peripheral arteriosclerotic changes in long-standing diabetes, as compared with the rarity of Charcot-joint formation, impairment of circulation was not considered an etiologic factor. Hodgson, Pugh, and Young (5) regard the syndrome as due entirely to osteomyelitis secondary to a chronic soft-tissue infection.

The process usually begins after several years of poorly regulated diabetes. Early signs and symptoms include relatively painless swelling of the tarsometatarsal region, with gradual eversion of the foot. The disease progresses slowly to partial or complete necrosis of the tarsal bones and obliteration of their normal joint relationships.

Pathologically, there is almost complete loss of normal bone structure, with some areas showing different stages of destruction and other areas presenting periosteal new-bone formation. Degenerative changes in the synovial membranes and moderately increased vascularity of the adjacent soft tissues are present, with hypertrophy of the vessel walls. Examination of sections of the peripheral nerves reveals edematous changes only.

CASE I: J. C., a white unmarried female, aged 39, has been a diabetic for nineteen years. Although she was intelligent and cooperative, proper control of the disease proved difficult. She took 25 units of protamine zinc insulin at bedtime and 10 to 25 units of regular insulin after each meal, varying the dosage according to the degree of glycosuria. About seven years prior to admission she first noticed swelling of her right foot. The edema was intermittent and was not associated with pain, although aching occurred after long periods of weight-bearing. During the three years prior to examination the deformity of the foot had increased to the point where only a large house slipper could be worn, though the condition remained relatively painless and the patient walked with only a slight limp. Four days before admission the edema suddenly increased and the foot became hot, reddened, greatly swollen, and tender.

Physical examination on admission revealed the following pertinent findings: blood pressure 132/84; eyes, ears, nose, and throat normal except for mild arteriovenous nicking of retinal vessels; heart, lungs, and abdomen within normal limits. Dorsalis pedis pulsation was normal on the left but was absent on

[1] Accepted for publication in June 1955.

Fig. 1. Case I. A. Extensive areas of bone destruction in the tarsal bones and absorption of heads of metacarpals. B. Lateral view. C. Patient's left foot for comparison.

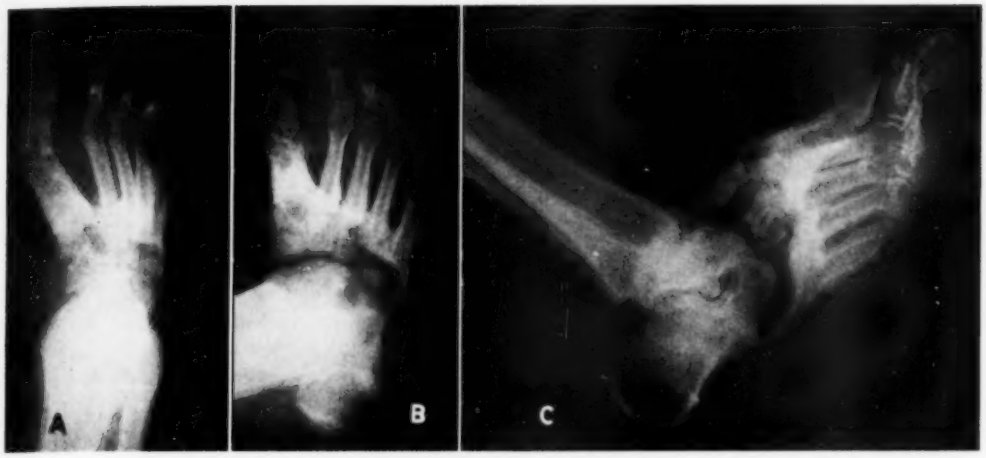

Fig. 2. Case II. A. Destructive changes with considerable eburnation and proliferation of bone. B and C. Special views demonstrating separation between proximal and distal tarsal bones.

the right (possibly not palpable as a result of the edema). Laboratory studies showed a moderate hypochromic anemia with normal white cell and differential counts. Repeated urinalyses revealed 1 to 4 plus sugar, occasionally 1 plus albumin, and a few leukocytes. The Kahn reaction was negative.

Roentgen examination of the foot (Fig. 1) demonstrated multiple areas of destruction in the tarsal bones, with complete dissolution of continuity between the metatarsals and phalanges of the second, third, fourth, and fifth digits.

The electrocardiogram was normal.

During the patient's hospital course she received 30 units of protamine zinc insulin daily, with varying amounts of regular insulin and a weighed diabetic diet. Control of the diabetes as determined by repeated blood and urine sugar determinations was only fair. In addition to the insulin, 600,000 units of procaine penicillin were administered daily. On the eighth hospital day the leg was amputated at a point 6 inches below the knee. The postoperative course was uneventful.

CASE II: V. L., a 43-year-old white housewife, was known to have had diabetes mellitus for five years. Four years prior to the present admission, diabetic gangrene developed in right foot and the fourth and fifth toes were amputated. Two years later the patient began to experience intermittent, slightly painful swelling of the left foot with slowly progressing deformity.

The diabetes had been well regulated by diet and 40 to 50 units of protamine zinc insulin daily. One week before admission the left foot became hot, swollen, and very painful. Diabetic control became erratic and the patient was placed on regular insulin four times daily, with dosage determined by frequent urine sugar determinations.

Positive physical findings were limited to the lower extremities. The dorsalis pedis pulse was palpable bilaterally. The left foot was edematous and tender, and the skin was brownish-red. The gross appearance was that of a subacute cellulitis.

Radiographic studies (Fig. 2) revealed an extensive neuropathic degenerative lesion involving the left foot and ankle, characterized by partial necrosis of the tarsal bones and a spontaneous osseous separation between the proximal and distal tarsals. Calcification was present in blood vessels and fascial planes of the lower part of the left leg.

Laboratory findings were normal except for a rather pronounced hypochromic anemia and a fasting blood sugar ranging from 180 to 290.

A left mid-thigh amputation was performed on the sixth hospital day. The patient received 1,000 c.c. of whole blood before and during the procedure. Postoperative recovery was uneventful.

Treatment of the joint lesions in diabetes is generally unsatisfactory. The changes, once begun, are slowly progressive in spite of antibiotic therapy and careful diabetic management. Parsons and Norton (6) report 2 cases in which the degenerative process was apparently arrested after lumbar sympathectomy, but Sheppe (7) describes 1 instance in which sympathectomy had no effect upon the disease process. Martin (8) and Antes (9) suggest immobilization of the foot and ankle by orthopedic appliances to prevent weight-bearing and further deformity. To obviate the extreme difficulty of regulating

diabetes in the presence of a chronic infection, and to relieve pain and deformity, the affected extremity is often amputated, as in the cases reported here.

SUMMARY

Neuropathic (Charcot) joints are an uncommon complication of diabetes mellitus.

The etiology is unknown, but theories regarding the origin of the condition include diminution of blood supply, peripheral neuritis, and extension to bone from a soft-tissue infection.

No specific treatment is efficacious, although in 2 instances the condition has been apparently arrested by lumbar sympathectomy; some benefit from immobilization has also been recorded.

In the present study 2 cases are reported; amputation of the affected limb was performed in each.

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SUMARIO

Articulaciones Diabéticas de Charcot

Las articulaciones neuropáticas de Charcot están consideradas como rara complicación de la diabetes azucarada. Repásase aquí la literatura y se presentan 2 casos; en ambos se ejecutó la amputación del miembro afectado. Los hallazgos roentgenológicos en el primer caso consistían en zonas multiples de destrucción ósea en los tarsianos, con disolución total de la continuidad entre los metatarsianos y las falanges de los dedos segundo, tercero, cuarto y quinto del pie. En el segundo caso, había una extensa lesión degenerativa neuropática que comprendía el pie y el tobillo izquierdos, caracterizada por necrosis parcial de los huesos del tarso y por separación ósea espontánea entre los tarianos proximales y distales.

Bilateral Embryoma of the Kidney: Patient Alive and Well Three Years After Treatment[1]

MYRON B. CLOSE, M.D.,[2] CARRELL A. PETERSON, M.D.,[3] and RICHARD P. JOHNSON, M.D.[4]

WILMS' TUMOR, OR embryoma of the kidney, is the most common malignant neoplasm of the abdomen in childhood. Several bilateral embryomas are reported in the literature, but to the best of our knowledge there has been only 1 such case with survival for an appreciable length of time. In that case, presented by Gross in 1953, the patient had survived for twelve years without sign of recurrence. A right nephrectomy had been performed and bilateral x-ray therapy administered. Microscopic proof of Wilms' tumor was, however, obtained only on the side of nephrectomy; biopsy of the tumor in the opposite kidney was not done.

The case reported here was seen in January 1952, because of bilateral abdominal tumors, which were subsequently proved microscopically to be Wilms' tumors. The patient is now living and well three years after right nephrectomy, biopsy of the left kidney, and bilateral x-ray therapy.

CASE REPORT

An 8-month-old white boy was admitted to the Children's Hospital of the East Bay (Oakland, Calif.) on Jan. 27, 1952, with bilateral upper abdominal masses and gross hematuria. The masses were discovered two weeks before admission on routine examination; hematuria was first observed two days prior to entry. There was no history of malaise, pain, weight loss, or arrest in development.

At the age of two months, the patient exhibited stridor, and an upper respiratory infection occurred. Roentgenograms obtained at that time revealed an enlarged thymus, which was treated elsewhere by irradiation. Subsequent studies at this hospital showed a vascular ring about the trachea and esophagus, consisting of an anterior (left) and a larger posterior (right) aortic arch with a normal left descending aorta. Division of the anterior arch was performed to relieve pressure on the trachea. Recovery was satisfactory, and the child was considered well until the discovery of the abdominal tumors.

The weight on admission was 21 pounds, and the temperature was 100° F. Physical examination revealed thickening and rubor of the tympanic membranes. The right flank was protuberant. A large, firm, non-movable, non-tender mass was present in the right upper quadrant, extending from beneath the costal margin almost to the umbilicus. The left kidney was twice its normal size and was also firm, non-movable, and non-tender. The liver and spleen were not palpable. Urinalysis showed a heavy concentration of red blood cells; the hemoglobin was 11.8 gm., the white blood count 4,000, and the differential cell count normal.

Intravenous urograms demonstrated large bilateral homogeneous masses compatible with enlarged kidneys (Fig. 1). The collecting system was well visualized on either side, and no calcification, disturbance in drainage, or marked hydronephrosis was noted. On the left side, the calyces were seen in the upper portion of the mass. The calyces of the right kidney were inferiorly placed in the mass, with deformity due to external pressure.

Surgical exploration of the right kidney was delayed because of an otitis media and an upper respiratory infection. A right nephrectomy was performed on Feb. 13 through a posterolumbar incision. A grossly encapsulated, firm, homogeneous, pink-gray tumor, 10 cm. in diameter, was found in the upper pole of the kidney. Only a small shell of the organ remained, inferiorly.

On microscopic section, the tumor was found to be an adenomyosarcoma (embryoma of the kidney). The postoperative course was satisfactory. Urinalysis revealed no red blood cells; the blood urea nitrogen was 16.8 mg. per cent.

On Feb. 23, x-ray therapy to the left kidney region was begun. The left abdominal tumor regressed rapidly under treatment, and by March 3 the kidney was barely palpable. Surgery was undertaken about one week later, through a left posterolumbar incision. Approximately two-thirds of a tumor, 5 cm. in diameter, at the lower pole of the kidney was removed. Complete excision was precluded by the vascular arrangement at the hilus of the kidney. Histologic examination showed the growth to be an embryoma.

Irradiation of the right renal fossa was begun on

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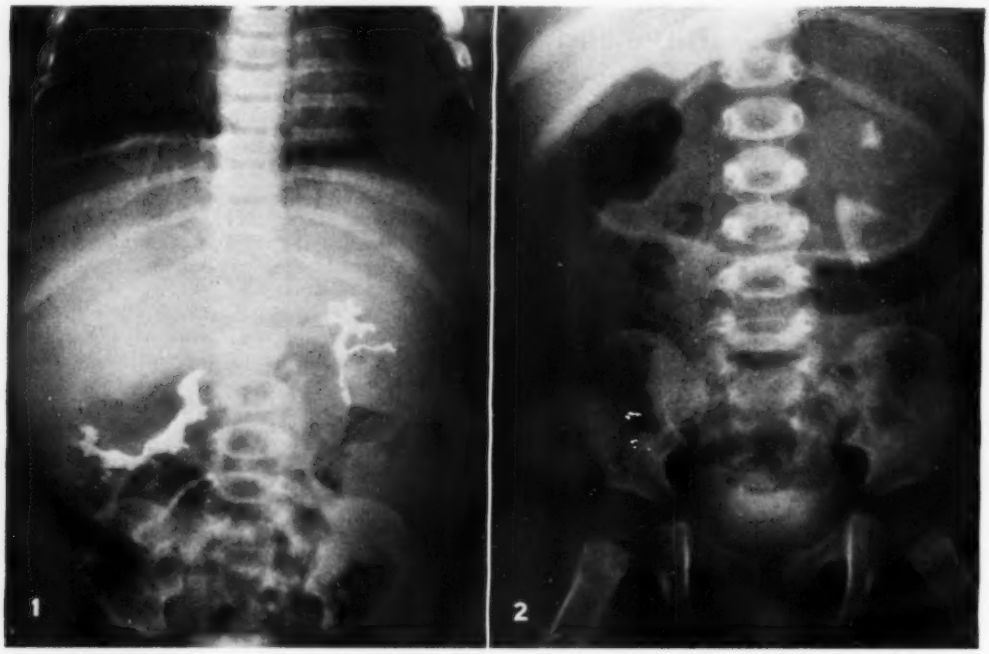

Fig. 1. Preoperative intravenous urogram (retouched), January 1952, showing marked deformity of right kidney and lower half of left kidney.
Fig. 2. Intravenous urogram, March 1954, two years after treatment.

March 14 and continued for a total of 1,600 r. A total tumor dose of approximately 2,300 r was given to the left kidney. The preoperative irradiation of the left kidney and postoperative therapy to both kidney areas were completed in a seven-week period, which included a one-week interval at the time of operation on the left kidney, when no therapy was given. The treatments were administered through opposing anterior and posterior fields measuring 10 × 10 cm. The quality of the x-rays was such that the half-value layer was approximately 0.5 mm. of copper.

Convalescence was uneventful, and periodic examinations have shown the patient to be in good health. Intravenous urograms were made in October 1953 and in March 1954 (Fig. 2). While not normal in appearance, the collecting system of the left kidney showed no changes suggestive of recurrence. In March 1954, the phenolsulfonphthalein test was borderline normal, 80 per cent of intravenously administered phenolsulfonphthalein being recovered in the urine within two hours. The blood urea nitrogen was 37 mg. per cent. Urinalysis was normal, with a specific gravity of 1.015. In December 1954, the blood urea nitrogen was 35.5 mg. per cent and the specific gravity of the urine was 1.010, suggesting a low renal reserve. The findings on repeated roentgen examinations of the chest have been normal. The child was active and appeared to be healthy in March 1955, at the time of the present report.

COMMENT

Since the great majority of those embryomas of the kidney which recur do so within the first nine months, Gross considers an arrest of eighteen months to be a cure. To the best of our knowledge, our case represents the first histologically proved bilateral Wilms' tumor with survival for more than a few months. The child was robust three years after treatment.

ADDENDUM: Since the above report was submitted, this patient has been seen at regular intervals in the Clinic of the Children's Hospital of the East Bay, Oakland, Calif. Excretion urograms obtained in April 1955, revealed no evidence of recurrence. Chest roentgenograms in March 1956 were normal. At that time the blood urea nitrogen was 23.2 mg. per cent. The patient appeared to be in excellent health

when last seen on April 30, 1956, four years after the completion of treatment.

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SUMARIO

Embrioma Bilateral del Riñón con el Enfermo Vivo y Sano a los Tres Años del Tratamiento

Preséntase un caso de embrioma bilateral del riñón, en el que el enfermo, de ocho meses de edad al ser hospitalizado, se hallaba vivo y sano a los tres años del tratamiento. Este parece ser el primer caso comunicado de tumor de Wilms comprobado histológicamente con una sobrevivencia de más de algunos meses. El tratamiento consistió en la nefrectomía derecha, biopsia del riñón izquierdo y roentgenoterapia bilateral. Al ingreso, los urogramas intravenosos revelaron grandes tumefacciones homogéneas bilaterales, con buena visualización de los sistemas colectores de ambos lados, y sin calcificación, trastornos del drenaje o hidronefrosis acentuada. En el lado izquierdo, se distinguían los cálices en la porción superior de la tumefacción. Los cálices del lado derecho estaban situados en la porción inferior de la tumefacción, con signos de deformidad, debidos a la compresión externa. Los urogramas tomados después del tratamiento, uno y dos años más tarde, aunque no tenían aspecto normal, tampoco revelaban alteraciones indicativas de recurrencia del tumor.

Agenesis of the Odontoid Process[1]

E. H. SCHULTZ, Jr., M.D., R. W. LEVY, M.D., and P. E. RUSSO, M.D.

FAILURE OF ossification of the odontoid process of the second cervical vertebra is a rare developmental anomaly which may be asymptomatic for many years. As a result of more thorough roentgenologic examinations, the condition has been noted with increasing frequency since its original description by Roberts in 1933 (1). We have had the opportunity of observing such a case with severe neurological symptoms.

Fig. 1. View of lateral cervical spine showing posterior displacement of the atlas on the axis. Note narrowing of the space between the posterior arch of C-1 and the spinous process of C-2, and the sclerosis of the posterior arch of C-1.

A search of the world literature revealed 14 examples of this anomaly, listed in Table I. In only a single instance were there persistent neurological findings. Associated congenital malformations have been observed in 2 cases: a partial fusion of the second and third vertebrae in 1 (7), and in the other a hemivertebra of the axis (8).

Fig. 2. Mid-line lateral laminagram, showing more clearly the posterior displacement of C-1 and sclerosis of the arch.

CASE REPORT

G. S. H., a 29-year-old Indian male, was admitted to the University of Oklahoma Hospitals on Aug. 6, 1954, with a history of progressive weakness in all four extremities for four months. In July 1954, two months prior to admission, he became confined to bed because of weakness and spasticity in his legs. He denied any sensory disturbances or bladder or bowel symptoms. There was no history of trauma.

Neurological examination revealed no abnormalities of the cranial nerves. Mobility of the neck was normal, with no tenderness over the cervical spine. A marked quadriparesis was present, in association with pronounced atrophy of the small muscles of the hands and peroneal group bilaterally. The deep tendon reflexes in all four extremities were extremely active, and there was a bilateral wrist and ankle clonus. Bilateral Babinski responses were elicited. Coordination and sensation were intact throughout. The clinical impression was amyotrophic lateral sclerosis. Routine laboratory studies, including a complete blood count and urinalysis,

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Fig. 3, A and B. Open-mouth views of odontoid reveal lateral subluxation of C-1 on C-2 which changes with position of the head.

TABLE I: FOURTEEN CASES OF AGENESIS OF THE ODONTOID PROCESS FOUND IN THE LITERATURE

Author	Cases	Sex	Age (years)	Trauma	Dislocation	Neurological Changes	Operative Fusion
Roberts (1933)	1	M	20	Yes	Yes	No	No
Lombard *et al.* (1939)	1	?	8	Yes	Yes	No	Yes
Weiler (1942)	2	2F	14, 12	1	2	No	1
Scannell (1945)	1	M	23	Yes	No	Yes	No
Lombard *et al.* (1945)	1	F	14	Yes	Yes	No	Yes
Ivie (1946)	1	M	23	Yes	Yes	Yes	No
Nievergelt (1948)	4	1F	35, 29				
		3M	10, 7	2	4	1	None
Stiefel (1950)	1	F	24	No	No	No	No
Miyakawa (1952)	1	M	29	Yes	No	Yes	No
Fullenlove (1954)	1	M	56	Yes	No	No	No

were negative. Spinal fluid examination, including the Queckenstedt sign, was normal.

Routine x-ray examinations of the skull and cervical spine disclosed some deformity of the second cervical vertebra. The odontoid process could not be identified, and the atlas was displaced posteriorly on the axis. The posterior arch of the first cervical vertebra showed a marked degree of sclerosis, with narrowing of the space between this arch and the spinous process of the axis. In a mid-line lateral laminagram, these findings were more clearly visualized (Figs. 1 and 2). Anteroposterior open-mouth exposures demonstrated a subluxation of the atlas to either side of the axis (Fig. 3). Air myelography revealed encroachment on the spinal canal by the first cervical vertebra with flexion of the neck, which permitted anterior dislocation of that vertebra on the axis (Fig. 4).

Following completion of these diagnostic studies, the neurosurgical consultant was called to see the patient and recommended exploratory laminectomy, which was performed on Aug. 26, 1954. A bony abnormality of the arch of C-1 was found. This was considerably thicker than normal and impinged on the spinal cord, indenting the dura mater. There was no epidural fat beneath the arch of C-1 or the lamina of C-2. The ligamentum flavum was firmly adherent to the underlying dura mater and could not be separated. On opening the dura mater, a moderately severe adhesive arachnoiditis was discovered, with numerous adhesions between the dura mater and leptomeninges. The spinal cord was about two-thirds the normal size. No instability of the involved vertebrae was demonstrated at the time of surgery; decompressive laminectomy alone was done.

Aside from a mild pneumonitis, the postoperative course was uneventful, and the patient was discharged from the hospital about one month later. A follow-up examination five months after surgery revealed gradual improvement in muscle power in the upper and lower extremities.

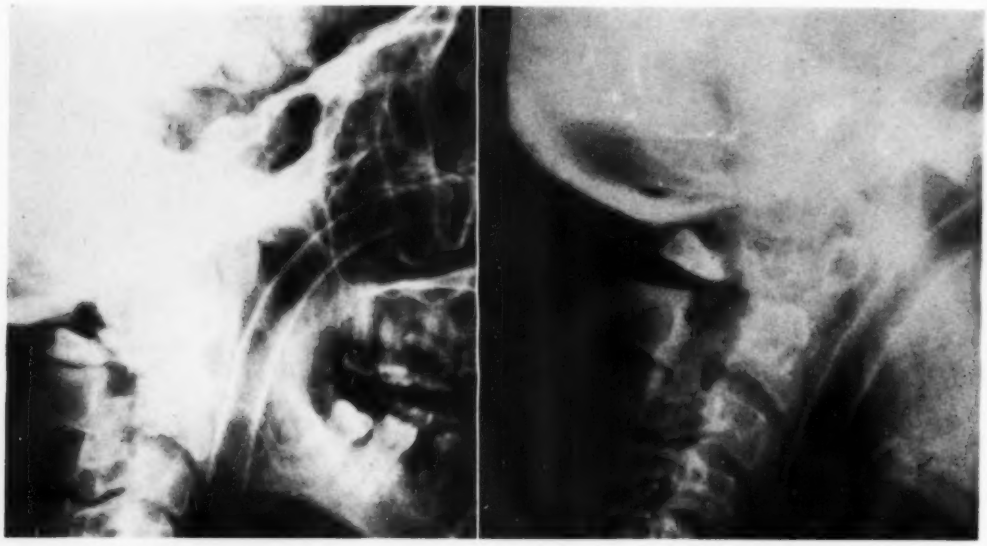

Fig. 4, A and B. Air myelograms, showing anterior dislocation and encroachment on the spinal canal by the first cervical vertebra with flexion of the neck.

SUMMARY

Report of a case of congenital absence of the odontoid process which exhibited neurological changes has been presented. The diagnosis was established by radiographic studies which included laminagrams and air myelography. Surgical exploration revealed a severe adhesive arachnoiditis with narrowing of the spinal cord at this level. Decompression laminectomy was done, and subsequent neurological examination showed partial regression of symptoms.

ACKNOWLEDGMENT: We are indebted to Dr. Alvin Rix, on whose service the patient was operated upon, for permission to report this case.

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SUMARIO

Agenesia de la Apófisis Odontoides

Preséntase la historia de un caso de falta congénita de la apófisis odontoides con alteraciones neurológicas asociadas. Clínicamente, el enfermo, varón de 29 años, manifestaba una notable cuadriparesia unida a destacada atrofia de los pequeños músculos de la manos y del grupo peroneo, bilateralmente. Se estableció el diagnóstico por estudios radiográficos que comprendieron laminagramas y aeromielografía. La exploración quirúrgica reveló una grave aracnoiditis adhesiva con estenosis d la médula espinal a dicho nivel. Se ejecutó una laminectomía para descompresión y el subsiguiente examen neurológico mostró regresión parcial de los síntomas.

EDITORIAL

The American Cancer Society

A "Year of Appraisal"—thus the American Cancer Society designates 1955 in its latest *Annual Report*. To no group of persons, either physicians or laymen, will this report be of greater interest than to radiologists, who play so vital a part in the diagnosis of cancer and the care of the cancer patient. Radiologists are serving on the Board of Directors and on many important committees of the Society; their names appear both as Regional Directors and Directors at Large, and they are everywhere active in local units. One of them, Dr. A. M. Popma, only recently served as President of the National Society. There is, therefore, no question that a large section of our specialty is familiar, at least in a general way, with the program and accomplishments of this important voluntary health organization. In order that a still larger group may be more definitely informed, we are offering here our own "appraisal," based on the report mentioned above. This seems particularly timely in view of the interest in the Third National Cancer Conference held in Detroit, under the joint sponsorship of the American Cancer Society and the National Cancer Institute, June 4–6.

The Society takes pride in the scope and democratic nature of its organization, in which laymen and physicians are about equally represented. There are three distinct organizational elements: The National Society, with headquarters in New York City; sixty Divisions scattered over the country, and 2,590 local Units.

The National Society is directly responsible for an overall program in public education through national media of information and for a nationwide program of fellowships for younger doctors. It administers the research program and acts in rapport with other national medical organizations and with the National Cancer Institute of the U. S. Public Health Service in furthering cancer control. Through it the Divisional activities are coordinated and furthered by means of technical assistance and materials. The Divisions are responsible, through their Units, for fund raising and for programs in education and services for physicians and patients in individual areas. All local programs must be approved by the local county medical society.

The program of the American Cancer Society is threefold—Education, Research, Service. The educational program is directed both to the public and the medical profession. The emphasis in public education is upon periodic examinations for cancer, recognition of danger signals, and the encouraging outlook in cases promptly diagnosed and adequately treated. To stress these aspects and to inform the layman on all phases of the cancer problem, every medium of publicity is used—radio and television, national news services and magazines, booklets, and exhibits.

Professional education aims first to provide doctors with the latest information on cancer and, second, to improve the means for diagnosis and treatment through special training courses. One of the most effective means of training are the national clinical fellowships in surgery, radiology, pathology, gynecology, urology, internal medicine, etc., for which grants are made through institutions approved for postgraduate training by the American Medical Association. Since the program started in 1948, a total of 864 such fellowships have been awarded. Fellowships for training in radiation therapy in Euro-

pean centers have been provided since 1953 and 12 fellows have been named. Postgraduate fellowships in exfoliative cytology have been granted to 61 pathologists. An advanced training program in biometry and epidemiology has been established at Yale University, directed to the specific problems of cancer.

A more general educational program is available to all doctors. A complete new library of medical films demonstrating diagnostic and treatment methods of proved effectiveness is now available. Two bimonthly periodicals are published by the National Society: *Cancer*, a scientific journal for the clinical investigator, and *CA, a Bulletin of Cancer Progress*, for the practitioner. The latter is distributed through the Divisions and is now received by 35 per cent of the country's registered physicians. Other publications include *Cancer Current Literature*, a monthly index to medical literature, and the Cancer Monograph Series, dealing with specific forms of cancer. A lending library of demonstration slides is available to lecturers at medical meetings, and exhibits are provided for state and national conventions.

Closely allied to the educational activities of the Society is the program of research, upon which the solution of the cancer program ultimately depends. During 1955 the Society allocated $6,100,000 for its national research program, and the Divisions in addition currently support research to the extent of $1,000,000 a year. In the past ten years grants have been of four major types: A. Research Grants-in-aid for specific studies; B. Institutional and Special Purpose Research Grants; C. Lung Cancer Grants; D. Research Fellowship and Scholar Grants for Advanced Research Training. Recently a special "Ad Hoc Research Policy Survey Committee" has recommended four types of grants for support of research and four types of grants for the training and support of investigators to provide a well coordinated research program for the future.

The service program, carried out largely through the Divisions and their Units by a host of devoted volunteer workers, is impressive. It embraces such features as the information center to serve as a link between the cancer patient and his family and the physician, local hospital, and social agencies; nursing services; preparation of dressings; loan closets of sickroom supplies; rehabilitation classes; and home visiting. Only those closely in touch with these subdivisions of the Society can appreciate the contributions made through such activities.

A word as to the financial growth of the Society may be added. In 1950 contributions were received which totaled just under $15,000,000 while in 1955 they amounted to $24,427,000. These funds were budgeted as follows: Education 29 per cent; Research 29 per cent; Service to the Cancer Patient 25 per cent; Fund Raising 10 per cent; Administration 7 per cent.

As stated above, radiologists have a special interest in cancer. The fact that approximately 250,000 persons will die of the disease this year presents us with a terrific challenge to support every effort designed to reduce this appalling figure. The American Cancer Society is doing an inestimable service, only touched upon in these brief remarks. It is worthy of unqualified support.

ANNOUNCEMENTS AND BOOK REVIEWS

RADIOLOGICAL SOCIETY OF SOUTHERN CALIFORNIA

At a recent meeting of the Radiological Society of Southern California, the following officers were elected: John D. Camp, M.D., Los Angeles, Chairman; Donald R. Laing, M.D., Pasadena, Vice-Chairman; Robert B. Engle, M.D., 318B W. California St., Pasadena, Secretary-Treasurer. Members of the Board of Directors are George Jacobson, M.D., Los Angeles, and James B. Irwin, M.D., San Diego.

CLEVELAND RADIOLOGICAL SOCIETY

New officers of the Cleveland Radiological Society are: Eric V. Baeyer, M.D., President; Frances A. Miller, M.D., Youngstown, Vice-President; Thomas W. Knickerbocker, M.D., Councillor; Arthur S. Tucker, M.D., 2065 Adelbert Road, Cleveland 6, Ohio, Secretary-Treasurer.

RADIOLOGIC SOCIETY OF HAWAII

The following officers have been elected by the Radiologic Society of Hawaii for the coming year: President, Hon Chong Chang, M.D.; Vice-President, George W. Henry, M.D.; Secretary-Treasurer, Richard D. Moore, M.D., St. Francis Hospital, Honolulu 17, Hawaii.

INDIANA ROENTGEN SOCIETY

Officers of the Indiana Roentgen Society for the coming year are as follows: President, William M. Loehr, M.D., Indianapolis; Vice-President, J. D. Imhof, M.D., Muncie; Secretary-Treasurer, Chester A. Stayton, Jr., M.D., 313 Hume Mansur Building, Indianapolis, Ind.

RADIOLOGICAL SOCIETY OF LOUISIANA

At the recent annual meeting of the Radiological Society of Louisiana, the following officers were elected: President, J. V. Hopkins, Jr., M.D., New Orleans; Vice-President, W. H. Carroll, M.D., Shreveport; Secretary-Treasurer, W. S. Neal, M.D., 602 Pere Marquette Bldg., New Orleans, La.

RADIOLOGICAL SOCIETY OF NEW JERSEY

At the annual meeting of the Radiological Society of New Jersey, May 16, 1956, the following officers were elected for the ensuing year: President, Dr. Carye-Belle Henle, Newark; Vice-President, Dr. Louis J. Levinson, Newark; Treasurer, Dr. William L. Palazzo, Teaneck; Secretary, Dr. George C. Green, 601 Grand Ave., Asbury Park, N. J.

OHIO STATE RADIOLOGICAL SOCIETY

The following officers have been elected by the Ohio State Radiological Society for the coming year: Dr. Donald English, Lima, President; Dr. Paul Jones, Zanesville, Vice-President and President Elect; Dr. Francis A. Miller, Youngstown, Treasurer; Dr. John R. Hannan, 10515 Carnegie Ave., Cleveland 6, Ohio, Secretary.

OKLAHOMA STATE RADIOLOGICAL ASSOCIATION

At a recent meeting of the Oklahoma State Radiological Association the following officers were elected for a two-year term: Lucien M. Pascucci, M.D., Tulsa, President; Simon Pollack, M.D., Tulsa, Vice-President; Sol Wilner, M.D., Medical Arts Building, Tulsa, Okla., Secretary-Treasurer.

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA

The new officers of the Asociación Puertorriqueña de Radiología are: Dr. Carlos Jiménez Torres, President; Dr. José Landrón Becerra, Vice-President; Dr. R. B. Díaz Bonnet, Suite 504, Professional Bldg., Santurce, Puerto Rico, Secretary-Treasurer; Dr. Oscar Ruiz Sosa and Dr. Carlos Guzmán Acosta, Directors.

SOCIEDAD DE RADIOLOGIA DEL ATLANTICO

At a recent meeting of the Sociedad de Radiologia del Atlantico, Barranquilla, Colombia, the following officers were elected: President, A. Támara-Merlano, M.D.; Vice-President, Oscar Ochoa, M.D.; Secretary-Treasurer, Raul Fernandez, M.D. Meetings are held monthly at the Instituto de Radiología, Barranquilla.

SOCIEDADE DE RADIOLOGIA DE PERNAMBUCO

The following officers have been elected by the Sociedade de Radiologia de Pernambuco to serve during 1955–57: President, Dr. Aguinaldo Lins; Vice-President, Dr. Ruy Caldas; Secretaries, Dr. Manoel Medeiros and Dr. Marcio Araujo; Treasurer, Dr. Mario Lemos; Assistant Treasurer, Dr. Moacyr Fagundes; Librarian, Dr. José Dagoberto Lôbo. Members of the Council: Dr. Avelino Cardoso, Dr. Paulo Campos, Dr. José Brito, Dr. Scylla Costa, Dr. Lucilo Maranhão. Address: Instituto de Radiologia da Faculdade de Medicina da Universidade do Recife, Caixa Postal 505, Recife Pernambuco, Brazil.

SOCIEDAD DE RADIOLOGIA CANCEROLOGIA Y FISICA MÉDICA DEL URUGUAY

The new officers of the Sociedad de Radiologia Cancerologia y Fisica Médica del Uruguay, for 1956–57, are: President, Dr. Luis A. Vazquez Piera; Vice-President, Dr. Rodolfo Tiscornia; Secretary-General, Dr. Ricardo Parada, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay; Recording Secretary, Dr. Roberto François; Treasurer, Dr. Enrique Capandegui; Directors, Dr. Felix Leborgne and Dr. Leandro Zubiaurre.

POSTGRADUATE COURSE IN RADIOLOGY UNIVERSITY OF SOUTHERN CALIFORNIA

The Postgraduate Division of the School of Medicine of the University of Southern California announces a postgraduate course in The Physics of Diagnostic and Therapeutic Radiology, to be presented weekly from 4:00 to 5:00 P.M., in the Department of Radiology, Los Angeles County Hospital, starting Friday, Sept. 7, 1956, and ending Feb. 1, 1957. The course is under the direction of George Jacobson, M.D., Professor of Radiology. Herman R. Haymond, Ph.D., Assistant Professor of Radiology, and Robert Pugh, Jr., Physicist in Radiology, will lecture.

This course is designed for physicians preparing for the specialty of radiology. It will consist of twenty lectures covering fundamental x-ray physics, determination of quality and quantity of radiation, tissue dosage from x-rays, radium and radon, radiation protection, and radiation biology.

Further information may be obtained from Phil R. Manning, M.D., Director, Postgraduate Division, School of Medicine, University of Southern California, 2025 Zonal Ave., Los Angeles 33, Calif.

DR. EDITH H. QUIMBY HONORED

At the thirty-fifth annual commencement exercises of Douglass College, Rutgers University, June 6, Dr. Edith H. Quimby was awarded an honorary Doctor of Science degree. Dr. Lewis Webster Jones, President of the University, in conferring the degree, cited Dr. Quimby for having put her knowledge of radiological physics to work in behalf of human life and for her "contribution of great import to mankind in this scientific age."

HONORS FOR DR. LAWRENCE REYNOLDS

At the June commencement exercises of Wayne University, Detroit, the honorary degree, Doctor of Laws, was conferred upon Dr. Lawrence Reynolds, editor of the *American Journal of Roentgenology, Radium Therapy, and Nuclear Medicine*. "Wayne University," reads the citation, "is proud to recognize the work of one of this country's greatest radiologists. His lifetime devotion to scholarly work as editor and bibliophile, his own research and his encouragement of young scientists, and his direction of the staff of a great hospital have helped to shape the whole course of modern radiological medicine."

"RADIOISOTOPES IN MEDICINE"

The U. S. Atomic Energy Commission has recently issued an 817-page book, *Radioisotopes in Medicine*, which is the complete proceedings of a special course on the subject conducted by the Oak Ridge Institute of Nuclear Studies in September 1953. Editors are Gould A. Andrews, Marshall Brucer, and Elizabeth B. Anderson of the ORINS Medical Division.

The volume is obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, $5.50 with paper cover.

ERRATUM

In the April issue of Radiology there are two unfortunate omissions in the paper by Dr. Edwin G. Williams on "Residual Radiation in Civil Defense." Both of these occur in the second column on page 597. The first two sentences in this column should be replaced by the following: "Three survey meters, two dosimeters, and a dosimeter charger specifically designed to meet civil defense needs have been produced according to FCDA specifications. The low-range survey meter is of the Geiger-counter type, is beta-gamma discriminating, and has a top range of 50 mr/hr. as calibrated with Cobalt 60. Its principal use will be as a training instrument and for monitoring food, water, and personnel. The medium-range survey meter is an ionization-chamber instrument for gamma radiation only; it has a top range of 50 r/hr. and will meet the major portion of the survey requirements in the period of heavy contamination."

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA 8 AUGUST–20 AUGUST 1955. VOL. 10: RADIOACTIVE ISOTOPES AND NUCLEAR RADIATIONS IN MEDICINE. A volume of 544 pages, with numerous tables and illustrations. Published by the United Nations, New York, 1956. Distributed in United States by Columbia University Press, New York. Price $8.00.

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA 8 AUGUST–20 AUGUST 1955. VOL. 11: BIOLOGICAL EFFECTS OF RADIATION. A volume of 402 pages, with numerous tables and illustrations. Published by the United Nations, New York, 1956. Distributed in the United States by Columbia University Press, New York, N. Y. Price $8.00.

THERAPEUTIC USE OF ARTIFICIAL RADIOISOTOPES. Edited by PAUL F. HAHN, Ph.D., Cancer Research Laboratories, Nashville, Tenn. A volume of 414 pages, with numerous tables and illustrations. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $10.00.

CANCER. A MANUAL FOR PRACTITIONERS. A volume of 322 pages. Published by American Cancer Society (Massachusetts Division), Inc., 462 Boylston St., Boston 16, Mass. Third Ed., 1956.

HIATUS HERNIA IN CHILDREN. A RADIOLOGIC-CLINICAL STUDY COMPRISING 58 CASES. Acta radiologica Supplement 129. By GREGERS THOMSEN. Translated from the Danish by Axel Andersen. A monograph comprising 200 pages of text and 24 plates including 64 figures. Published by Danish Science Press Ltd., Copenhagen, 1955. Price Sw. Kr. 25:–

ELECTROKYMOGRAPHY, WITH SPECIAL REFERENCE TO VALVULAR PULMONARY AND INFUNDIBULAR STENOSIS. Acta radiologica Supplement 134. By ULF RUDHE. Translated from the Swedish by Erica Odelberg. From the Roentgen Diagnostic Department (Director: Sven Roland Kjellberg) of the Paediatric Clinic, Karolinska Sjukhuset, Stockholm, Sweden. A monograph of 206 pages, with 108 figures and 3 tables. Published by Acta radiologica, Stockholm 2, Sweden, 1956. Price Sw. Kr. 30:–

BIOPHYSICAL INVESTIGATIONS OF URINARY CALCULI. AN X-RAY CRYSTALLOGRAPHIC AND MICRORADIOGRAPHIC STUDY. Acta radiologica Supplement 133. By CURT LAGERGREN. From the Department for Physical Cell Research, Karolinska Institutet, and the Roentgen Diagnostic Department, Karolinska Sjukhuset, Stockholm, Sweden. A monograph of 72 pages, with 33 illustrations. Published by Acta radiologica, Stockholm 2, 1956. Price Sw. Kr. 25:–

ASSESSING THE CURABILITY OF CANCER. Acta radiologica Supplement 132. By T. W. LEES, Edinburgh. From the Law Hospital, Carluke, Lanarkshire, Scotland. A monograph of 54 pages, with 14 figures and 3 tables. Published by Acta radiologica, Stockholm 2, Sweden, 1956. Price Sw. Kr. 20:–

DEVELOPMENT OF APPARATUS AND METHODS FOR ROENTGEN STUDIES IN HAEMODYNAMICS. Acta radiologica Supplement 130. By ÅKE GIDLUND. From the Roentgen Department (Director: Dr. Carl Sandström), St. Eriks Hospital, Stockholm, Sweden. A monograph of 70 pages, with numerous illustrations and tables. Published by Acta radiologica, Stockholm 2, Sweden, 1956. Price Sw. Kr. 25:–

RHUMATOLOGIE CLINIQUE. By PIERRE P. RAVAULT, Professeur de Clinique Médicale à la Faculté de Lyon, Médecin de l'Hôpital E. Herriot, and GEORGES VIGNON, Professeur agrégé à la Faculté de Lyon, Médecin des Hôpitaux. A volume of 604 pages, with 180 figures. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6e, 1956. Price 4,000 fr. (paper), 4.600 fr. (cloth).

NOUVELLE ORIENTATION DU TRAITEMENT DU MAL DE POTT DE L'ADULTE. DIAGNOSTIC PRÉCOCE. TRAITEMENT MÉDICO-CHIRURGICAL. By S. DE SÈZE and J. DEBEYRE, with the collaboration of SIMONE RAMPON, CL. GUÉRIN, and CL. MOREAU. A monograph of 102 pages, with numerous illustrations. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris 6e, 1956. Price 900 fr.

RÖNTGENDIAGNOSTIK DES HÜFTGELENKS. Fortschr. a. d. Geb. d. Röntgenstrahlen. Ergänzungsband 77. By Prof. Dr. Med. R. GLAUNER, Chefarzt der Röntgen- und Radiumabteilung am Marienhospital, Stuttgart, and Doz. Dr. Med. Habil. W. MARQUARDT, Leitender Arzt der orthopädischen Klinik, "Paulinenhilfe," Stuttgart. A volume of 168 pages, with 293 illustrations. Published by Georg Thieme Verlag, Stuttgart, 1956. Price DM 57.–

ANGIOGRAPHIE UND KLINIK. TECHNIK, INDIKATIONEN, KLINISCHE BEDEUTUNG SOWIE FEHLER UND GEFAHREN DER ARTERIOGRAPHIE UND PHLEBOGRAPHIE. By RAINER GOTTLOB, Facharzt für Chirurgie, I. Assistent an der chirurgischen Abteilung des Kaiser-Franz-Josef-Spitals, Wien (Vorstand: Professor Dr. F. Mandl). A monograph of 94 pages, with 6 text figures and 20 plates including 50 illustrations. Published by Wilhelm Maudrich, Wien IX., Spitalgasse lb. Price DM 19.–

Book Reviews

CHEST X-RAY DIAGNOSIS. By MAX RITVO, M.D., Assistant Clinical Professor of Radiology, Harvard Medical School; Instructor in Radiology, Tufts

Medical School; Lecturer on Radiology, Boston University School of Medicine; Roentgenologist-in-Chief and Director, Department of Radiology, Boston City Hospital; Associate Radiologist, Beth Israel Hospital, Boston, Mass.; Radiologist, Memorial Hospital, Roxbury, Mass.; New England Sinai Hospital for Diseases of the Chest. A volume of 640 pages, with 633 illustrations and a color plate. Published by Lea & Febiger, Philadelphia. Second Ed., thoroughly revised, 1956. Price $16.00.

In this second edition of Chest X-Ray Diagnosis, issued four years after the first, the author has revised his text, introducing new material and new technics developed in the interval. Some new sections have been added and some appearing in the earlier edition have been enlarged. Among the latter is that on congenital heart disease, which has undergone considerable expansion in view of data made available through improved methods of clinical and radiologic diagnosis.

About one-half of the text is devoted to the lungs and a quarter to the cardiovascular system, while chapters on the mediastinum, pleura, diaphragm, thoracic cage, and the soft tissue of the neck account for the remainder.

As in the original edition, the descriptive material is concisely presented, making the work particularly useful for reference. Though it is not to be regarded as an exhaustive treatise, most of the essentials are included. The illustrations are of good quality and reproduced in the negative phase, which is always helpful.

The work is recommended to radiologists and clinicians interested in diseases of the chest.

CANCER OF THE LUNG. PATHOLOGY, DIAGNOSIS, AND TREATMENT. By MILTON B. ROSENBLATT, M.D., Associate Professor of Medicine, New York Medical College; Visiting Physician and Chief of Chest Clinic, New York City Hospital; Fellow, American College of Chest Physicians, American College of Cardiology, New York Academy of Medicine, American Medical Association; and JAMES R. LISA, M.D., Director, Pathology Service, New York City Department of Hospitals; Director of Laboratories and Pathologist, Doctors Hospital; Fellow, American College of Physicians, American Association of Pathologists and Bacteriologists, New York Academy of Medicine, American Medical Association. A volume of 330 pages, with 129 figures. Published by Oxford University Press, New York, 1956. Price $15.00.

As the title indicates, this work covers three main phases of cancer of the lung—the pathology, the clinical manifestations and various types of examination contributing to the diagnosis, and therapy, surgical and palliative. Except for a brief discussion of smoking and cancer, the etiologic features receive little consideration.

For the chapters on bronchoscopy, exfoliative cytology, surgery, and palliative irradiation, the authors have enlisted the aid of specialists in these fields. It is unfortunate that a roentgenologist was not chosen to contribute the chapter on the roentgen examination, which is the most important of the special diagnostic procedures.

Within the space of some 300 pages there is included a great deal of information on pulmonary cancer. Much of the material, however, has to do with fully developed or advanced disease as demonstrated by late roentgen changes and autopsy findings.

Numerous roentgenograms, photographs, and photomicrographs are reproduced, and each chapter carries its own extensive bibliography. The work will be of greatest value to clinicians and surgeons.

CAUSAL FACTORS IN CANCER OF THE LUNG. By CARL V. WELLER, M.S., M.D., Chairman of the Department of Pathology and Professor of Pathology in the Medical School, and Pathologist to the University Hospital, University of Michigan, Ann Arbor, Mich. The Beaumont Lecture, Wayne County Medical Society, Feb. 7, 1955. A monograph of 114 pages, with 20 figures and 12 tables. Published by Charles C Thomas, Springfield, Ill., 1956. Price $3.00.

From the Beaumont Lecture delivered before the Wayne County Medical Society in Detroit, in 1955, this monograph on the etiology of lung cancer has been developed. Following a chapter on General Considerations, the author discusses possible occupational factors including an account of the Schneeberg and Joachimsthal miners, the role of infection, atmospheric pollution incident to industrialization and motor transport, and tobacco smoking.

This is an erudite but readable discussion of a subject that is currently attracting wide attention. Those interested will find in this slight volume, with its comprehensive bibliography, a valuable source of information.

LUNG FUNCTION IN COALWORKERS' PNEUMOCONIOSIS. By J. C. GILSON and P. HUGH-JONES, in collaboration with P. D. OLDHAM and F. MEADE. Medical Research Council Special Report Series No. 290, containing 266 pages, with 96 illustrations and 43 tables. Published by Her Majesty's Stationery Office, London, 1955. Distributed in the United States by the British Information Services, 30 Rockefeller Plaza, New York, N. Y. Price £1 1s. 0d. net. ($3.78).

In the 290th of the valuable Special Report Series of the British Medical Research Council, the authors record their experience with physiological tests to measure various aspects of lung function. This publication is a real contribution and should be carefully studied by all who are interested in the tremendous subject of pneumoconiosis, which is so

important in our present industrial age. In addition to the adaptation of physiological tests to the problems of shortness of breath in pneumoconiosis, an attempt is made to correlate the physiological findings with changes demonstrated on the roentgenograms. The authors have produced a volume that is exceedingly important and every radiologist should be aware of their studies.

MEDICAL PHOTOGRAPHY. RADIOGRAPHIC AND CLINICAL. By T. A. LONGMORE, Hon. F.S.R., Principal, Kodak School of Medical Radiography and Clinical Photography; Hon. Editor of "Radiography"; Member of Council, Education Committee and Board of Examiners of the Society of Radiographers; Late Senior Instructor in Radiographic and Medical Photography at the Royal Army Medical College, etc. Foreword by Brigadier D. B. McGrigor, O.B.E., M.B., Ch.B., D. M. R. E., Hon. F. S. R , Consulting Radiologist, The War Office; President, British Institute of Radiology 1939–42. A volume of 990 pages, with 76 plates, 320 text figures, and 95 tables. Published by The Focal Press, London. Fifth Ed., 1955. Distributed in the United States by The American Photographic Book Publishing Co., Inc., 33 West 60th St., New York 23, N. Y. Price $15.00.

Medical Photography, brought out in England during the last war as a textbook for the Armed Forces, has been revised and enlarged several times, until the present Fifth Edition comprises almost 1,000 pages. Approximately one-quarter of the text is devoted to photographic aspects of radiographic technic, exclusive of positioning, furnishing valuable source material for the radiologist. The sections on color photography and flash technics have been revised and expanded to include the most recent developments. Other chapters deal with cineradiography, kymography, stereoscopy, photomicrography, and electrocardiography.

This book contains much of value to any who are interested in the principles and practice of photography. To the clinical photographer and radiologist it will prove a storehouse of practical information.

L'ANGIOGRAPHIE VERTÉBRALE. By PIERRE NAMIN, Chef de Clinique de la Faculté de Médecine de Paris. A monograph of 110 pages, with 40 photographs and 27 diagrammatic drawings. Published by G. Doin & Cie, 8, Place de L'Odéon, Paris 6e, 1955. Price 1,800 fr.

This small monograph gives a relatively good presentation of the present knowledge concerning vertebral angiography. Egas Moniz, who introduced carotid angiography, was also the first to perform vertebral angiography, in 1933. Other historical aspects are briefly considered.

The anatomy of the vertebral arterial and venous drainage systems is described, and the angiographic technic is outlined. Under local anesthesia 10 c.c. of Diodone (iodopyracet U. S. P.) is injected into the vertebral artery just above the transverse foramen of the first cervical vertebra. Lateral and fronto-suboccipital views are obtained, occasionally supplemented by the basal view. A *moulage* technic of injection of the vertebral artery at autopsy is described, which has aided considerably in the understanding of angiographic anatomy.

The pathological conditions demonstrable by vertebral angiography are presented in the form of case reports with accompanying roentgenograms. Thus angle tumors, retrosellar masses, chordoma, pinealoma, cerebellar cyst, occipital abscess, and stenosis of the aqueduct are shown to produce vascular displacements. In thrombosis of the internal carotid artery the anterior and middle cerebral arteries are filled *via* the circle of Willis. Thrombosis of the posterior cerebral artery is revealed by nonfilling of that vessel. Cirsoid aneurysm and angioma of the cerebellum show characteristic vascular patterns. Meningiomas near the tentorium may be demonstrated by both the vascular pattern and displacement.

Many of the roentgenograms are accompanied by diagrammatic sketches.

ERLÄUTERUNGEN ZU DEN STRAHLENSCHUTZNORMEN FÜR MEDIZINISCHE RÖNTGENEINRICHTUNGEN, -ANLAGEN UND RÖNTGENSCHUTZKLEIDUNG. DIN 6811, 6812, und 6813. Im Auftrage des Fachnormenausschusses Radiologie im Deutschen Normenausschuss in Arbeitsgemeinschaft mit der Deutschen Röntgengesellschaft. By H. GRAF and A. SCHAAL, Erlangen. A paper-bound volume of 90 pages, with 10 illustrations. Published by Georg Thieme Verlag, Stuttgart. Distributed in the United States and Canada by the Intercontinental Medical Book Corporation, New York, N. Y., 1955. Price DM 8.70.

The radiological standardization committee of the German Board on Standardization in collaboration with the German Röntgen Society has sponsored this little booklet in which the rules for radiation protection adopted in 1943 have been brought up-to-date, going into effect on July 1, 1955. The sections DIN 6812 and DIN 6813 of the old report have been maintained and a new section DIN 6813 has been added.

DIN 6811 deals with protective rules and measures in the manufacture of medical x-ray equipment with voltages from 15 to 250 kv. The chapter covers the weekly permissible dose of 300 milliroentgens for total body exposure and 1,500 milliroentgens for limited exposures, as of the hand or foot; use of protective gowns; construction of x-ray tubes and tube-heads; thicknesses and constructions of primary and secondary radiation barriers; pro-

tection from other electron tubes, as for example valve tubes. Two chapters deal with protective measures in x-ray diagnosis and in x-ray therapy, with respect to proper construction of equipment, filtration, diaphragms, area of treatment, distance, etc.

DIN 6812 deals with protective measures for the installation of diagnostic and therapeutic x-ray departments with generators producing up to 250 kv. The permissible dose previously mentioned is again introduced and practical suggestions regarding size and height of rooms, construction of floors and walls, use of various absorbing barriers (zinc, steel, barium, concrete, brick) are given for a voltage range from 50 to 250 kv.

DIN 6813 suggests rules for the manufacture of lead-rubber protective gowns, coats, light and heavy aprons, light and heavy gloves, arm and leg protective covers. Lead-equivalent thickness for light and heavy aprons or gloves is given as 0.2 and 0.4 mm., respectively.

Future publication of DIN 6814 on standardization of technical terms and principles, and DIN 6815 on tests of radiation protection in medical x-ray installations is announced.

Changes in the previous rules were made after the International Congresses of Radiology in London (1950) and Copenhagen (1953). They pertain mostly to permissible doses. There exists now a rather satisfactory agreement between the new German protective rules and those of this and other countries.

LA BRONCOGRAFIA. By DR. DARIO GANDINI, Aiuto dell'Istituto di Radiologia e Fisioterapia, dell'Ospedale degli Infermi di Biella, with a preface by Prof. Enrico Benassi, Titolare di Radiologia Medica dell'Università di Torino. A volume of 202 pages, with 138 text figures and 9 plates including 23 schematic drawings. Published by Abruzzini Editore, Rome, 1955.

This work is based on extensive personal experience in the radiological study of the bronchi and on an obvious knowledge of chest diseases. It represents a welcome and rather radical departure from the style of many continental authors, inasmuch as it gives a practical and complete approach to the problems of bronchography without lengthy quotations of the previous literature.

The first part of the book takes up, in succession, contrast media, bronchographic technic, indications, contraindications, and accidents, closing with an excellent chapter on the anatomy of the bronchial tree. The second part deals with bronchial deformities due to chronic bronchitis, asthma, bronchiectasis, emphysema, silicosis, cysts, suppurative processes, simple stenosis, neoplasms, and tuberculosis.

This text is well written and abundantly illustrated. An extensive bibliography is attached.

Aside from the very good treatment of the subject material, this book should appeal to American readers because the author has made extensive use of the localized technic of bronchography by means of curved Metras catheters introduced directly in the bronchus to be studied. This procedure may be dangerous in inexperienced hands, but, done by experts, gives results which are difficult to duplicate. Of special interest are several cases of fistulous connections between bronchi thus demonstrated.

In the opinion of the reviewer, this book is one of the best contributions to the subject of bronchography which has appeared in recent years.

VERTEBROPATIE SEGMENTARIE RARE. By ROBERTO GHISLANZONI and GIUSEPPE PORRO, Instituto di Radiologia della Università di Genova (Dir. Prof. A. Vallebona). A volume of 204 pages, with 99 illustrations. Published by Edizioni Minerva Medica, Genova, 1956.

In this small volume, the authors collect their personal experience concerning certain rare localized diseases of the vertebrae. The book is divided into two parts: The first deals with anatomy, symptomatology in certain affections of the spine, and radiographic technic. The second covers bone infarcts, infectious and parasitic processes, neoplasms, reticulo-endothelioses, and monostotic Paget's disease, and presents discussions on "ivory" vertebra and vertebra plana.

As to be expected in a work issuing from the University of Genoa, stratigraphy occupies a large role in the diagnostic technics described.

The bibliography is extensive, but largely Italian. The printing and reproductions are acceptable.

In Memoriam

GEORGE M. LANDAU, M.D.

1892–1956

In the death of George M. Landau on April 10, 1956, Radiology lost another of its pioneers. Dr. Landau was born in Chicago, Dec. 16, 1892, and received his early education in the public schools and in St. John's Military Academy, Delafield, Wisconsin, where he made an excellent scholastic record and still found time to engage in such sports as football, basketball, and rowing. He was graduated in 1911 and was honored by being chosen Senior Class Statistician. The influence of his early military training never left him.

Following graduation from St. John's, Dr. Landau entered the School of Medicine of the University of Illinois, from which he received his degree in medicine in 1915. While serving his internship in Grant Hospital, Chicago, he came under the influence of

George M. Landau, M.D.

the late Dr. Max J. Hubeny, who became his preceptor in radiology.

To the day of his death Dr. Landau remained an ardent radiologist, and his work and devotion to his field won him the respect and friendship of all with whom he came into contact. His activities were legion, not the least of which was his devotion to the cause of the x-ray technicians. He did much to improve their status and for many years served on the American Registry of X-Ray Technicians, as well as being an advisor to their national society. He was at various times Director of Radiology in the following Chicago hospitals: Hahnemann Hospital, Grant Hospital, University Hospital, Chicago Memorial Hospital, and Women's and Children's Hospital. He served in a similar capacity in St. Charles Hospital, Aurora, Ill., and Oak Forest Infirmary, Oak Forest, Ill. In 1942 he became Director of the Department of Radiology at Cook County Hospital, Chicago. He was formerly Associate Clinical Professor in the Department of Roentgenology in the School of Medicine, Loyola University (1948–51), and had been Assistant Professor of Radiology in Northwestern School of Medicine since 1951.

Among Dr. Landau's major accomplishments were numerous scientific papers presented at both national and local levels. He was active in medical and radiological organizations and could always be relied upon to serve faithfully upon committees. He was Secretary and later Chairman of the Radiological Section of the Illinois State Medical Society and was Secretary and President of the Chicago Roentgen Society. He was a Diplomate of the American Board of Radiology; a fellow of the American College of Radiology, the American Medical Association, and the Chicago Roentgen Society; a member of the Radiological Society of North America, the Chicago Medical Society, the Sociedad Columbiana de Radiologia, and an honorary member of the American Society of X-Ray Technicians.

Any account of Dr. Landau's activities would be incomplete without mention of his record in World War I. With his military background, he promptly enlisted in June 1917 and served with distinction until April 1919. His chief duty was as Radiologist, Army Evacuation Hospital No. 42, France. Later, in civil life, he served as Commander of his American Legion Post.

Dr. Landau's death followed a lingering illness due to a bronchogenic neoplasm. His charming personality and his ready flow of wit and wisdom will be missed and his memory will be ever cherished by all who were privileged to know him. Immediate survivors are his wife, Peggy, and a son, George, Jr.

ROBERT A. ARENS, M.D.

Robert Allen Davis, M.D.

ROBERT ALLEN DAVIS, M.D.

1886–1956

The following resolution of the Radiological Society of Virginia records the death of Dr. Robert Allen Davis, a member of the Radiological Society of North America since 1934.

"Dr. Robert Allen Davis, who died on April 29th, 1956, following a short illness, was born November 20, 1886, in York County, Va. He was graduated from the University of Virginia with an M.D. degree in 1909. Shortly after this he spent a short time in general practice, but then returned to Newport News, Va., where he spent the remainder of his life, with the exception of the time that he spent in the United States Army during World War I.

"When he first entered the practice of medicine he was connected with the Elizabeth Buxton Hospital in Newport News, Va., as a general practitioner, and after World War I started the X-ray Department in this hospital, and was a pioneer in x-ray work on the lower Virginia Peninsula. His interest in general practice was very strong because of his love to be with, and associated with people. In the early 30's he confined his work to x-ray entirely and was very instrumental in furthering the development of Elizabeth Buxton Hospital, and was entirely responsible for the development of the X-ray Department.

"Because of his relationship with general practice, he was most sympathetic to the problem of the general practitioner. He was always willing, and never too busy, to discuss the x-ray findings, and to be of any help, in any way that he might, to any doctor who entered his office.

"He was well read on current literature and was always willing to listen to any discussion that might further his medical knowledge.

"He was a member of the American Medical Association, Medical Society of Virginia, Radiological Society of North America, Virginia Radiological Society, Virginia Peninsula Academy of Medicine, and also a member of the staff of Dixie, Riverside and Mary Immaculate Hospitals.

"He is survived by his widow, Mrs. Julia Calvert Davis, and four brothers.

"Therefore, be it resolved, that Dr. Davis's death removed from the Peninsula a beloved physician, wise counselor and a devoted friend. It is also resolved that this tribute be recorded in the official minutes of the Radiological Society of Virginia and a copy of the same be sent to the family of the deceased, the Medical Society of Virginia, and the Radiological Society of North America."

CLAYTON W. ELEY, M.D.
JOHN A. COCKE, M.D.
FRANK A. KEARNEY, M.D.

HARVEY FLEMMING MACK

1878–1956

It is with deep regret that we record the death, on May 29, of Harvey F. Mack of the Mack Printing Company, which for many years has not only printed RADIOLOGY but has cooperated in innumerable ways in its publication. Mr. Mack was born in 1878, and his connection with the printing industry dates back to 1900, when he became chief clerk to Dr. Edward Hart, then Editor of the *Journal of the American Chemical Society* and owner of the Chemical Publishing Company. By 1907 Mr. Mack held the controlling interest in the Eschenbach Printing Company, which he had acquired a few years earlier in partnership with Charles A. Hilburn. The company became known for its printing of scientific and technical periodicals and when the name was changed, in 1926, to the Mack Printing Company, its reputation was established on a firm basis, both in the printing industry and in scientific circles. When Mr. Mack retired as President in March 1956 to become Chairman of the Board of Directors, he could look with satisfaction upon the results of his pioneering efforts in the printing of scientific and engineering periodicals in America, for at that time some sixty journals were coming regularly from the Company's presses.

Mr. Mack was engaged in many civic enterprises and received numerous honors. He was a member of various scientific societies, including the American Chemical Society, and was awarded an honorary degree of Doctor of Humane Letters from Lafayette College. No tribute, however, speaks more eloquently of the character of the man than an excerpt from an engrossed scroll signed by all Mack Company employees and presented to their President on his seventy-fifth birthday.

"The high standard of personal character and fair dealing which he has exemplified and the spirit of helpfulness and service which has motivated his life have won the admiration and affection of all whose lives he has touched.

"His good deeds have made the world a better place, and as he celebrates his seventy-fifth birthday, it is right that he be made aware of the esteem of those who have benefited from the opportunities for work and service his vision and sound leadership have provided."

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Theodore R. Miller, M.D., 139 E. 36 St., New York 16, N. Y.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

ASSOCIATION OF UNIVERSITY RADIOLOGISTS. *Secretary-Treasurer*, Robert J. Bloor, M.D., 260 Crittenden Blvd., Rochester 20, N. Y.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 E. 59th St., Chicago 37.

SOCIETY OF NUCLEAR MEDICINE. *Secretary*, R. G. Moffat, M.D., 2656 Heather St., Vancouver 9, Canada.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James J. Riordan, M.D., 550 W. Thomas Rd., Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Joe A. Norton, M.D., 843 Donaghey Bldg., Little Rock. Meets quarterly.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Austin R. Wilson, M.D., 540 N. Central Ave., Glendale 3.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Richard A. Kredel, M.D., 65 N. Madison Ave., Pasadena 1. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, H. B. Steward, Jr., M.D., 2920 Capitol Ave., Sacramento. Meets last Monday of each month, September to May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

RADIOLOGICAL SOCIETY OF SOUTHERN CALIFORNIA. *Secretary-Treasurer*, Robert B. Engle, M.D., 318B W. California St., Pasadena.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, C. W. Bruner, M.D., 2456 Fourth Ave., San Diego 1. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, Howard L. Steinbach, M.D., University of California Medical Center, San Francisco 22. Meets quarterly, at Grison's Steak House.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, Thomas N. Foster, M.D., 630 E. Santa Clara St., San Jose. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, James T. English, M.D., 2000 Van Ness Ave., San Francisco 9. Meets third Thursday at 7:45, Lane Hall, Stanford University Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Dorr H. Burns, M.D., 1776 Vine St., Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, John Burbank, M.D., Meriden Hospital, Meriden. Meets bimonthly, second Wednesday.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary-Treasurer*, Melvin O. Goodman, M.D., 1930 K St., N.W., Washington 6. Meets third Wednesday, January, March, May, and October, 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Donald H. Gahagen, M.D., 320 Sweet Bldg., Fort Lauderdale. Meets in April and in October.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, André S. Capi, M.D., 300 N. 20th Ave., Hollywood, Fla. Meets monthly, third Wednesday, 8:00 P.M.

NORTH FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Marvin Harlan Johnston, M.D., Five Points Medical Center, Jacksonville 4. Meets quarterly, March, June, September, and December.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Charles M. Silverstein, M.D., 3254 Peachtree Rd., N. E. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Herbert M. Olnick, M.D., 417 Persons Bldg., Macon, Ga. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta. Meets first Thursday of each month.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary-Treasurer*, Richard D. Moore, M.D., St. Francis Hospital, Honolulu 17. Meets third Monday of each month.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary-Treasurer*, R. Burns Lewis, M.D., 670 N. Michigan Ave., Chicago 11. Meets at the Sheraton Hotel, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, Chester A. Stayton, Jr., M.D., 313 Hume-Mansur Bldg., Indianapolis 4. Meets twice a year, first Sunday in May and during fall meeting of State Medical Association.

TRI-STATE RADIOLOGICAL SOCIETY (Southern Indiana, Northwestern Kentucky, Southeastern Illinois). *Secretary-Treasurer*, Robert E. Beck, M.D., 600 Mary St., Evansville, Ind. Meets last Wednesday, October, January, March, and May, 8:00 P.M., at the Elks' Club, Evansville, Ind.

Iowa

IOWA RADIOLOGICAL SOCIETY. *Secretary*, James T. McMillan, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, G. S. Ripley, Jr., M.D., W. Iron Ave., Salina. Meets in the Spring with the State Medical Society and in the Winter on call.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, David Shapiro, M.D., Jewish Hospital, 217 E. Chestnut St., Louisville 6. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets second Tuesday of each month.

RADIOLOGICAL SOCIETY OF LOUISIANA. *Secretary-Treasurer*, W. S. Neal, M.D., 602 Pere Marquette Bldg., New Orleans.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Walter A. Russell, M.D., Augusta General Hospital, Augusta. Meets in June, October, December, and April.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, Nathan B. Hyman, M.D., 1805 Eutaw Place, Baltimore 17. Meets third Tuesday, September to May.

MARYLAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Paul W. Roman, M.D., 1810 Eutaw Place, Baltimore 17.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, E. F. Lang, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

UPPER PENINSULA RADIOLOGICAL SOCIETY. *Secretary*, Arthur Gonty, M.D., Menominee. Meets quarterly.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, O. J. Baggenstoss, M.D., 1953 Medical Arts Bldg., Minneapolis 2. Meets in Spring and Fall and at annual meeting of State Medical Association.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Packer, M.D., 621 High St., Jackson. Meets monthly, on third Tuesday, at 6:30 P.M., at the Hotel Edwards, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary-Treasurer*, D. R. Germann, M.D., University of Kansas Medical Center, Kansas City 3, Kans. Meets last Friday of each month.

GREATER ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Sam J. Merenda, M.D., 45 Berry Road Park, Glendale, Mo. Meets on fourth Wednesday, October to May.

Montana

MONTANA RADIOLOGICAL SOCIETY. *Secretary*, John Stewart, M.D., Billings Clinic, Billings. Meets annually.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James F. Kelly, Jr., M.D., 816 Medical Arts Bldg., Omaha. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Thomas J. Crowe, M.D., 53 Center St., Northampton, Mass. Meets second Friday of October and April.

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Raymond A. Dillon, M.D., 24 Wedgemere Ave., Winchester, Mass. Meets monthly on third Friday, October through May, at the Hotel Commander, Cambridge, Mass.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnson, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, George G. Green, M.D., 601 Grand Ave., Asbury Park. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BROOKLYN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Theodore Kamholtz, M.D., 152 Clinton St. Meets first Thursday, October through May.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clayton G. Weig, M.D., 135 Linwood Ave., Buffalo. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, and October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Solomon Maranov, M.D., 1450 51st St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 9:00 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Frances M. Behrendt, 19 Clinton Rd., Garden City, N. Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, John A. Evans, M.D., 525 E. 68th St., New York 21.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert R. Wadlund, M.D., Albany Hospital, Albany. Meets in the capital area second Wednesday, October, November, March, and April. Annual meeting in May or June.

RADIOLOGICAL SOCIETY OF NEW YORK STATE. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo. Meets annually with the State Medical Society.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, T. Paul Guest, M.D., 277 Alexander St., Rochester. Meets at Strong Memorial Hospital, 8:15 P.M., last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maynard G. Priestman, M.D., New Rochelle Hospital, New Rochelle, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, William H. Sprunt, M.D., North Carolina Memorial Hospital, Chapel Hill, N. C. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Marianne Wallis, M.D., Minot. Meets in the Spring with State Medical Association; in Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Hannan, M.D., 10515 Carnegie Ave., Cleveland 6.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Arthur R. Cohen, M.D., 41 S. Grant Ave., Columbus. Meets second Thursday, October, November, January, March, and May, 6:30 P.M., Fort Hayes Hotel, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Arthur S. Tucker, M.D., 2065 Adelbert Road, Cleveland 6. Meets at 7:00 P.M., fourth Monday, October, November, January, February, March, and April, at Tudor Arms Hotel.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Richard J. Neubauer, M.D., 831 Carew Tower, Cincinnati 2. Meets first Monday, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, W. S. Koller, M.D., 60 Wyoming St., Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sol Wilner, M.D., Medical Arts Bldg., Tulsa.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, N. L. Bline, M.D., 210 Jackson Tower, Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club, Portland.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Richard Raines, M.D., 214 Medical-Dental Bldg., Portland 5, Ore. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Walter P. Bitner, M.D., 334 State St., Harrisburg. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Roderick L. Tondreau, M.D., 3400 Spruce St., Philadelphia 4. Meets first Thursday of each

month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Norman Tannehill, M.D., 601 Jenkins Bldg., Pittsburgh 22. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at the Hotel Roosevelt.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John H. Freed, M.D., 4200 E. Ninth Ave., Denver 7, Colo. Next meeting Aug. 16–18, 1956, at Denver.

South Carolina

SOUTH CAROLINA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Samuel W. Lippincott, M.D., 103 Rutledge Ave., Charleston. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Donald J. Peik, M.D., 303 S. Minnesota Ave., Sioux Falls. Meets during annual meeting of State Medical Society.

The Southwest

SOUTHWESTERN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Gordon L. Black, M.D., 1501 Arizona Bldg., El Paso.

Tennessee

MEMPHIS ROENTGEN SOCIETY. *Secretary*, Benjamin E. Greenberg, M.D., 294 Annella St., Memphis 11. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George K. Henshall, M.D., 311 Medical Arts Bldg., Chattanooga 3. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH RADIOLOGICAL CLUB, *Secretary*, Albert H. Keene, M.D., 3707 Gaston Ave., Suite 116, Dallas. Meets monthly, third Monday, 6:30 P.M., at the Greater Fort Worth International Airport.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Leslie L. Lemak, 616 Medical Arts Bldg., Houston 2. Meets fourth Monday at the Doctors' Club.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Bldg., San Antonio 5, Texas. Meets at Brook Army Medical Center, second Wednesday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., 1308 Manteo St., Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Eva L. Gilbertson, M.D., 1317 Marion St., Seattle 4. Meets fourth Monday, September through May, at 610 Pine St., Seattle.

West Virginia

WEST VIRGINIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. Paul Elkin, M.D., 515–519, Medical Arts Bldg., Charleston. Meets concurrently with annual meeting of State Medical Society, and at other times as arranged by Program Committee.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club.

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. W. Moir, M.D., Sheboygan Memorial Hospital, Sheboygan.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary-Treasurer*, Dr. R. B. Díaz Bonnet, Suite 504, Professional Bldg., Santurce, P.R.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, Guillaume Gill, M.D.; *Associate Honorary Secretary-Treasurer*, Norman M. Brown, M.D., *Central Office*, 1555 Summerhill Ave., Montreal 25, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTRO-RADIOLOGIE MÉDICALES. *General Secretary*, Ls Ivan Vallée, M.D., Hôpital Saint-Luc, 1058 rue St-Denis, Montreal 18. Meets third Saturday of each month.

L'ASSOCIATION DES RADIOLOGISTS DE LA PROVINCE DE QUEBEC. ASSOCIATION OF RADIOLOGISTS OF THE PROVINCE OF QUEBEC. *Secretary*, Isadore Sedlezky, M.D., 3755 Cote St. Catherine Road. Meets four times a year.

CUBA

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Collateral Cerebral Circulation Through the Ophthalmic Artery and Its Efficiency in Internal Carotid Occlusion. Renzo Bossi and Carlo Pisani. Brit. J. Radiol. **28:** 462–469, September 1955.

When a thrombotic occlusion occurs in the cerebral vessels, a compensatory circulation can be established in three ways:

1. Basilar collateral circulation *via* the circle of Willis.
2. Collateral circulation through anastomotic branches between the external carotid artery, internal carotid artery, and vertebral artery.
3. Peripheral collateral circulation through anastomoses joining the three vascular areas of the brain. This happens when the occlusion is in one of the three major cerebral arteries.

The existence of anastomoses between the external and internal carotid arteries by way of the ophthalmic artery and its branches is confirmed clinically by the rarity of ocular involvement in cases of ligation or thrombosis of the homolateral carotid artery. In these cases the basilar collateral flow through the anterior communicating artery is mainly directed to the anterior cerebral artery. To get sufficient blood supply for the eye and optic nerve, a collateral circulation must be established and the only possible way is over the ophthalmic artery. The authors found 13 examples of angiographic demonstration of collateral ophthalmic artery circulation reported in the literature, and present 3 cases of their own.

Arteriography in the first case showed sharp interruption of the internal carotid artery just below the bifurcation. Collateral circulation by way of the internal maxillary and ophthalmic arteries was demonstrated, with a retrograde filling of part of the internal carotid artery and filling of all of the sylvian group.

In the second case a sharp interruption of the internal carotid artery was demonstrated 2 cm. from the bifurcation. One collateral circulation was shown by way of the internal maxillary-lacrimal-ophthalmic artery. A second connection was shown between the anterior branches of the superficial temporal artery and the lacrimal artery. There was backflow into the internal carotid artery, with filling of the sylvian group and anterior cerebral artery.

The third case showed occlusion of both internal carotid arteries. Collateral circulation by way of one ophthalmic artery could be demonstrated.

It is doubtful, however, if the ophthalmic circulation alone can reach a good working efficiency because of the fineness of its vessels. Only in cases of gradual occlusion is it possible that a progressive adaptation of anastomoses could permit a blood flow suitable for functional recovery.

Thirteen roentgenograms.

JOACHIM GPOELLER, M.D.
Cleveland City Hospital

Radiography of the Skull with Short-Distance Contact Therapy Equipment. P. Ott and K. Rosteck. Fortschr. a. d. Geb. d. Röntgenstrahlen **83:** 401–408, September 1955. (In German)

The authors have studied the feasibility of using contact therapy equipment to obtain films of various parts of the skull. The equipment they use is the van der Plaats, "Nahstrahlrohr," manufactured by C. H. F. Mueller in Hamburg. An attachment (*Tubus*) is placed on the end of the x-ray tube which fixes the distance between the focal spot and the skin at 38 mm. if the tube is brought into direct contact with the skin. In order to minimize the radiation effect upon the skin, a 0.5 cm. "Kerr-Filter" (see Fortschr. a. d. Geb. d. Röntgenstrahlen **81:** 823, 1954) is used. The equipment operates at a tube current of 44 kv and 2 ma. The exposure varies between four and eight seconds if screens are used in the cassettes and the radiation applied to the skin ranges between 30 and 60 r for one exposure.

The authors describe three applications of the method, for views that cannot easily be obtained by any other procedure. The first application is for a lateral view of the zygomatic arch. With conventional equipment, one can readily obtain an axial view of both zygomatic arches, in dorsiflexion of the head, by placing a cassette under the lower jaw and directing the x-rays axially from the vertex toward the base of the skull; the lateral view through the skull is less satisfactory because of superimposition of the bony shadows of the opposite side. With the film placed along the lateral surface of the skull and the contact tube on the opposite side, almost perpendicular to the film and in contact with the skin in the area of the articular tubercle, a view of the zygomatic arch is produced at right angles to the axial view. This shows clearly any displacement in case of fracture. The technical refinements of positioning are described in detail.

The second application is for demonstration of the atlanto-occipital joint. The head is anteflexed as far as possible. The x-ray tube is placed upon the glabella of the frontal bone between the eyes and tilted so that the central ray is directed toward the joint, striking the middle of the film, which is placed in back of the occipital bone. Both eyes are protected by means of lead rubber disks. The film produced will allow a clear visualization of the atlanto-occipital joint without any disturbing bone shadows.

The third application is for the visualization of fractures along the lateral side of the skull.

Six roentgenograms; 2 photographs; 1 diagram; 1 table.

WILLIAM A. MARSHALL, M.D.
Chicago, Ill.

Towards Safer Angiography. C. B. Sedzimir. J. Neurosurg. **12:** 460–467, September 1955.

In a total of 2,855 cerebral angiograms, culled from several reports in the literature, there was a procedural mortality of 0.8 per cent, with a roughly equal percentage of permanent complications and approximately 2 per cent transient complications. The author reports on a series of 273 carotid angiograms obtained during 1954 in 169 patients, with no mortality and no complications. This favorable result is attributed to several factors. One of the most important of these the author believes to be the use of general anesthesia with endotracheal intubation during the procedure. This tends to abate vascular spasm. Also of significance are the avoidance of high concentrations of the opaque material (the author uses Diodone, 42.5 per

cent), limitation of the number of injections to two at any one time, and withdrawal of the needle during development of the films. A very small amount of saline and sodium citrate is given during the period of rearrangement of the apparatus between exposures for lateral and axial views, never more than 20 ml. A 6-inch polyethylene tube, 1/16 inch in diameter, is used as a link between needle and syringe. The maximum number of injections in any one artery is four at a sitting. If further angiographic studies are necessary, they are undertaken only after a lapse of a week.

Angiography carries a higher risk of mortality in cases of cerebral thrombosis than in other lesions and should not be undertaken except in cases of doubt and after assessment of the particular problem. In patients with intracranial hemorrhage, the author prefers to wait about ten days after the acute episode, although on occasion he has performed the procedure within two or three days of the hemorrhage.

Five tables.

RICHARD G. LESTER, M.D.
University of Minnesota

Open Indirect Method of Vertebral Angiography. J. P. Schaerer. J. Neurosurg. **12:** 487–494, September 1955.

The technic of vertebral angiography advocated by the author has the advantage, he believes, of being comparatively easy to perform, and he feels, also, that it is a comparatively safe procedure. Lindgren's direct percutaneous method has the disadvantage of necessitating some haste, and also requires considerable practice before the operator becomes proficient in its use. The Radner catheterization method is complicated, involves the sacrifice of the radial artery, and also introduces the danger of vascular trauma due to the catheter.

The author's open indirect method involves exposure of one or both carotid arteries under general anesthesia. A 16-gauge Tuohy needle is introduced into the right carotid, pointed toward the heart. With a piece of plastic tubing the needle is connected to a 3-way stopcock, which in turn is connected to a drip of 5 per cent glucose in water with sodium citrate added. In between injections this drip is used to keep the system patent. For the actual injection a 20-c.c. syringe is attached to the stopcock. Twenty cubic centimeters of Diodrast are introduced while an assistant occludes the carotid cephalad to the injection site and a blood-pressure cuff placed high on the arm suppresses the arterial flow to the arm. Positioning of the patient for different views entails no difficulty. The author prefers to wait after each injection and to view the wet films before continuing the examination, thus avoiding the dangers incident to a rapid succession of injections.

In 52 instances, excellent filling was obtained 44 times, adequate visualization in an additional 7 cases, and in 1 case the result was unsatisfactory.

Five roentgenograms; 1 diagram.

RICHARD G. LESTER, M.D.
University of Minnesota

Experimental Orbitography. P. Thomas Manchester, Jr., José Bonmati, Ted F. Leigh, and F. Phinizy Calhoun, Jr. Am. J. Roentgenol. **74:** 508–517, September 1955.

Iodopyracet (Diodrast) Injection for Orbital Tumors. P. Thomas Manchester, Jr., and José Bonmati. Arch. Ophth. **54:** 591–595, October 1955.

To determine the usefulness of orbitography as a diagnostic procedure, animal experiments were done. Rabbits were used, and a water-soluble contrast medium (Diodrast) was injected directly into the orbits. One cubic centimeter of the medium introduced into the muscle cone produced films of satisfactory quality, but injury to the eye and orbital tissues frequently resulted. When administration of a compound containing hyaluronidase, which promotes diffusion and rapid absorption of different media in soft tissues, preceded the injection of Diodrast, the resulting orbitograms were less satisfactory than those in the earlier series but the irritating effects seemed to have been eliminated.

In view of the results in the experimental studies, Manchester and Bonmati made further observations on man. The procedure, however, proved less satisfactory than in animals. Spasm of the central retinal artery occurred as a complication, and it was found that the combination of Diodrast and hyaluronidase often was not evenly distributed throughout the orbit, with the result that misleading shadows were produced, leading to an erroneous diagnosis of orbital tumor. Although safer than Diodrast alone, Diodrast preceded by hyaluronidase is not recommended for general use.

The first of the papers listed above is illustrated by 13 roentgenograms, 1 drawing, and 1 photomicrograph. Three tables summarize the gross and microscopic changes in the animals studied. The second paper includes 3 illustrations and 4 tables.

Dacryocystography. II. The Pathologic Lacrimal Apparatus. Byron H. Demorest and Benjamin Milder. Arch. Ophth. **54:** 410–421, September 1955.

In a previous communication (Arch. Ophth. **51:** 180, 1954. Abst. in Radiology **63:** 886, 1954), the authors described a technic for demonstrating the anatomy of the normal lacrimal apparatus, employing Pantopaque. It was found that the time normally required for the contrast medium to disappear from undiseased lacrimal passages was less than thirty minutes. Although the nasolacrimal system may appear patent on ordinary irrigation, impaired drainage function can be demonstrated by dacryocystography, and use of the procedure in all cases of epiphora is recommended. Preoperatively, dacryocystography is indicated to show (1) the character of the structures adjacent to the sac, (2) the position and extent of the stenosis, and (3) the size and tonus of the sac. Postoperatively, it is useful in evaluating the results of the surgery.

Eleven cases are presented to illustrate some of the more common pathological conditions of the lacrimal passages which may be encountered on dacryocystography.

Thirteen roentgenograms.

Fibrous Dysplasis of the Skull. N. Ameli. Lancet **2:** 480–482, Sept. 3, 1955.

Three cases of fibrous dysplasia affecting the bones of the skull are reported. Two were monostotic, with signs and symptoms of an intracranial space-occupying lesion. In 1 instance, the mass was removed; in all 3 cases the lesions were examined histologically.

The patients, usually adolescent, are seen either with a slowly progressive intracranial lesion or a mass growing externally from the bones of the skull. Other symptoms depend upon the site of the lesion: in 1 of the author's cases unilateral exophthalmos and blind-

ness were the chief signs; in the second patient facial paralysis, deafness, and unilateral parkinsonism on the opposite side were noted; in the third, unilateral facial disfigurement was the main symptom.

The radiologic appearance, also, depends upon the location of the lesion. In Cases I and II, shell-like calcification around the tumor mass was most striking; in Case III, irregular destruction of bone and new bone formation in adjacent areas were demonstrable throughout the affected areas. The most important roentgen signs can be summarized as irregular destruction of bone in some areas and calcification in others, thinning and expansion of some affected bones, and shell-like calcifications marking the limit of the tumor.

Angiography is considered helpful in differential diagnosis between monostotic fibrous dysplasia of the skull and meningioma. In the latter, vascularity of the tumor is striking, whereas fibrous dysplasia always shows an avascular area.

One roentgenogram; 2 photomicrographs; 1 photograph.

Skull Deformities Secondary to Chronic Subdural Hematoma Acquired During Early Childhood. Guido Lombardi. Radiol. med. (Milan) **41**: 849–862, September 1955. (In Italian)

Subdural hematoma, which may occur even after a relatively minor injury, is not uncommon in infancy. At times the hemorrhage increases beyond the limit compatible with survival, but more often it (*a*) is reabsorbed, (*b*) undergoes calcification (*haematoma durae matris ossificans* of Schüller), or (*c*) persists indefinitely. In this last event, it will produce certain typical roentgenologic features, as (1) cranial asymmetry of various degrees; (2) upward, and sometimes inward, displacement of the lesser sphenoidal wings and of the floor of the anterior cranial fossa; (3) forward displacement of the anterior wall of the medial cranial fossa and outward displacement of the squamous portion of the temporal bone; (4) enlargement of the medial cranial fossa in all diameters.

The author believes that encephalography and arteriography should be performed in all cases to avoid diagnostic errors. Five personal observations, confirmed surgically, are included.

Nineteen roentgenograms. E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

Enlargement of the Sella Turcica. A Report on 27 Cases. J. L. G. Thomson. Brit. J. Radiol. **28**: 454–461, September 1955.

Changes of the normal appearance of the sella turcica may be caused by intrasellar, suprasellar, and remote lesions. To distinguish between these conditions is often impossible on a plain film. To emphasize this point the author reports a series of 27 cases. Two common factors were present in most of this group: (1) a mass in or alongside the sella, producing direct pressure on it; (2) raised cerebrospinal fluid pressure. In some cases with enlargement of the third ventricle, these two factors operate together.

Six cases of intrasellar lesions are presented—5 chromophobe adenomas and 1 eosinophil adenoma—to illustrate the variations in the roentgen pattern. The most salient features were: enlargement of the sella; erosion and deepening of the floor of the sella; thinning or destruction of the dorsum sellae; undercutting and elevation of the anterior clinoid processes. The true size of the tumor could be appreciated only by air studies. Ventriculography showed posterior displacement of the front end of the third ventricle.

Ten suprasellar and parasellar lesions are reported: craniopharyngioma, meningioma, astrocytoma, chordoma, ependymoma, gliomatosis, plasmocytoma, aneurysm, and syphilitic meningitis. This large variety of cases showed the same changes of the sella as the first group, and, in addition, depression of one anterior clinoid process. Ventriculography and arteriography again were essential for proper evaluation of the condition.

Enlargement of the third ventricle due to aqueduct stenosis was seen in 4 cases. In 1 case a block of the aqueduct was caused by a pontine tumor, and in 1 there was kinking of the aqueduct due to a cerebellar tumor. The roentgen changes in the sella in this group were the same as in the cases above. Severe sellar destruction was observed in 1 case.

Sellar changes were found also in cases in which the size of the third ventricle was normal or unknown. A parietal meningioma caused a deepening of the sella with destruction of the floor, thinning of the dorsum sellae, and sharp anterior clinoid processes. One case of thalamic astrocytoma showed only a deepened sella. Similar findings were associated with an angioma in the temporal lobe. A large sella was found also in a patient with myelomatosis of the lumbar spine and in 1 with neurofibromatosis. In these last 2 cases, however, no further intracranial investigation was performed.

From this survey, only four features appear to show any constancy: (1) "ballooning" of the sella with intrasellar tumors; (2) foreshortening of the dorsum sellae with suprasellar tumors; (3) depression of an anterior clinoid process with a suprasellar tumor; (4) elevation of an anterior clinoid process with an intrasellar tumor.

Twenty-six roentgenograms; 2 diagrams.

JOACHIM GFOELLER, M.D.
Cleveland City Hospital

Radiological Calcification in Posterior Fossa Tumours. A. C. Begg and R. G. Robinson. Brit. J. Radiol. **28**: 470–472, September 1955.

The demonstration of deposits of calcium in posterior fossa tumors is important for their localization and for suggesting the pathological type. The authors record the experience with 82 cases of verified posterior fossa tumors investigated and treated in the Dunedin Hospital, Dunedin, New Zealand. In this series, there were 53 intrinsic tumors, including 25 astrocytomas, 7 ependymomas, 7 hemangiomas, 9 medulloblastomas, 2 miscellaneous gliomas, and 3 granulomas. Four of these showed calcification: 3 astrocytomas and 1 ependymoma. Twenty-nine tumors were found to be extrinsic, consisting of 22 neuromas of the eighth nerve, 2 neuromas of the fifth nerve, 3 meningiomas, and 2 epidermoids. Calcification was demonstrated in only 1 extrinsic tumor, a meningioma.

The calcification in posterior fossa tumors does not differ from that in other brain tumors. Radiologically, three distinct patterns of calcium deposition were distinguished: (1) scattered or "nodular" deposits, consisting in discrete rounded calcifications distributed sporadically within the tumor, found in astrocytomas and ependymomas; (2) curvilinear or "cystic" deposits, in which the calcium is laid down in the wall

of a cyst as a thin, curved, continuous or interrupted line; (3) homogeneous or "granular" deposits, a rare form, rather characteristic of a meningioma.

Four roentgenograms; 1 table.

JOACHIM GFOELLER, M.D.
Cleveland City Hospital

Physiological or Secretory Sialography. Philip Rubin, Irving M. Blatt, John F. Holt, and James H. Maxwell. Ann. Otol., Rhin. & Laryng. **64:** 667–688, September 1955.

The authors have made a thorough study of sialography in an attempt to standardize the procedure and to determine the best contrast medium. They found Pantopaque preferable to Lipiodol or Iodochloral and concluded that a closed system of injection is superior to the open method. They have added to the usual procedure an emptying study of the gland. The filled gland is stimulated by having the patient suck on a lemon, or some other gland stimulant is used, such as minted gum, candy, or diluted vinegar. Since emptying is a physiological process, they have called this procedure "physiological or secretory sialography."

After topical application of 10 per cent cocaine hydrochloride, a punctate director is inserted into the mouth of Stenson's duct, the duct is dilated with olive-tipped probes, and a polyethylene catheter is then inserted for a distance of 3 to 4 cm. The injection of the contrast medium is carried out slowly until the patient signals that definite pain is present. The amount injected varies between 0.5 and 1.5 c.c. and should not exceed 2.0 cm. Upon completion of the injection, the open end of the catheter is plugged with a toothpick. Roentgenograms are taken of the injection phase. Then the catheter is removed and the gland stimulated. Post-stimulation films are taken after the mouth has been rinsed. The entire procedure takes about twenty minutes. Retention of the medium for more than five minutes after stimulation indicates abnormality of the gland (unless it has been overinjected).

Sialography is indicated in cases of suspected neoplasm, calculi, sialectasis, fistulas, and strictures. The sole contraindication is acute inflammation.

Nine roentgenograms; 2 drawings; 1 photograph.

G. J. WOOLHANDLER, M.D.
Shreveport, La.

Functional Disturbances of the Upper Swallowing Mechanism. J. R. Lindsay. Ann. Otol., Rhin. & Laryng. **64:** 766–776, September 1955.

Functional disturbance of the upper swallowing mechanism may be due to abnormality of musculature, innervation, or psychic control. While direct observation of the mechanism is not feasible, useful objective evidence can be obtained by fluoroscopy and roentgenography.

The most important muscles in propulsion of food through the pharynx are those of the soft palate, the constrictors and elevators of the pharynx, and the muscles which close the upper aperture of the larynx. Muscular diseases which may cause difficulty in swallowing are: myasthenia gravis, diffuse generalized scleroderma, dermatomyositis, and myasthenia associated with such systemic diseases as tuberculosis or thyrotoxicosis and with senility. The patients are unable to drive the food into the esophagus and to empty the vallecula (the space behind the base of the tongue and in front of the epiglottis) and the pyriform space on either side of the base of the tongue. In these cases arrest of barium may be demonstrated in the anteroposterior, oblique, and lateral roentgenograms. The cricopharyngeus muscle tends to retain its power as a constrictor to prevent escape of barium from the esophagus back into the pharynx during the Valsalva maneuver.

Innervation disturbances may be motor or sensory. The motor supply is from the tenth and fifth cranial nerves. The sensory is from the ninth and tenth. Paresis may be due to (1) peripheral neuritis, (2) the jugular foramen syndrome with compression of nerves, (3) lesions affecting the nerves as they leave the bulb and enter the jugular foramen, as tumor, fracture, or meningoencephalitis, and (4) intracranial lesions, such as hemorrhage or embolism affecting the bulb, tabes, poliomyelitis, disseminated sclerosis, syringomyelia, and amyotrophic lateral sclerosis. In such cases, aspiration of food, especially liquids, during the swallowing act is common. Roentgen study shows delay or failure of barium to pass, as well as retention in the epiglottic valleculae and in the pyriform fossae. Atonic spasm of the pharyngeal musculature may occur in central nervous system disorders, as tetanus or brain injury.

The Valsalva maneuver is of particular value with nerve involvement: with the patient recumbent, the cricopharyngeal sphincter may not function, thus permitting barium to regurgitate upward from the esophagus.

The author could not demonstrate any abnormality with barium study in disturbances of psychic origin such as globus hystericus. He suggests that pulsion diverticulum may be related to spasm of the cricopharyngeal constrictors.

Fifteen roentgenograms. WILLIAM SNOW, M.D.
Shreveport, La.

The Cervical Spine and the Globus Syndrome. Lewis F. Morrison. Ann. Otol., Rhin. & Laryng. **64:** 753–765, September 1955.

Complaint of a "lump" in the throat is not unusual and frequently no definite cause can be found. The patient is often considered neurotic and the case is designated "globus hystericus." A cause for the globus syndrome which has not been given sufficient attention is osteoarthritis of the cervical spine.

When degeneration of an intervertebral disk occurs, accompanied by inflammation and production of spurs, cervical nerve compression occurs. The most common area of involvement is C-5, C-6, and C-7. It is the compression of the cervical nerves that causes the "globus."

Roentgenograms will show degenerative arthritic changes in the cervical spine and some diminution in the size of the intervertebral space. They will also rule out cardiospasm and esophageal defects as a cause of the difficulty. Taken in conjunction with the clinical findings the roentgen observations may lead to a correct diagnosis.

Among the therapeutic measures which have been employed are physiotherapy, medication, irradiation (200 r once or twice a week for three or four treatments), and surgery. Usually the simpler measures will give relief, lending additional support to the diagnosis of osteoarthritis as a cause of a "lump in the throat."

Six roentgenograms. G. J. WOOLHANDLER, M.D.
Shreveport, La.

Ossifying Fibroma of the Paranasal Sinuses. Emanuel M. Skolnik and Elio J. Fornatto. Ann. Otol., Rhin. & Laryng. **64:** 689–700, September 1955.

The authors present 4 cases of ossifying fibroma of the paranasal sinuses and correlate the clinical, radiological, surgical, and pathologic data, with the object of finding criteria for preoperative diagnosis.

Ossifying fibroma of the face and skull is considered to be a variant of the intraosseous form of fibroma. Other names for this condition have been sarcoma psammosum, sarcoma osteogeneticum, and psammoma. As recently as 1949 the term psammo-osteoid-fibroma was proposed. American and British authors generally report these lesions as calcifying or ossifying fibromas. It is generally agreed that the disease is related to monostotic fibrous dysplasia.

Ossifying fibromas are slow growing and are often unsuspected until their development causes expansion of the walls of the sinuses. They may be associated with sinusitis which does not respond to treatment. Local swelling, tenderness, displacement of the eye, and functional disturbance may be present. Roentgenographically the tumors are demonstrable as rounded masses of various size in the sinuses, with diffuse clouding and bone destruction. These findings are non-specific, however, and therefore other neoplastic lesions, such as carcinoma, sarcoma, osteochondroma, adamantinoma, Ewing's tumor, etc., may have to be considered, as well as osteomyelitis.

Therapeutically, surgical excision and curettement of the involved bone appear to be adequate. If this is not done carefully, however, local recurrence may develop. Radiotherapy has proved to be of little value.

Three roentgenograms; 2 photomicrographs; 3 photographs.

WILLIAM SNOW, M.D.
Shreveport, La.

THE CHEST

A Study of the Practical Significance of High-Voltage Technic in Chest Radiography. W. Frik, H. Gajewski, F. Wachsmann, and C. E. Buchheim. Fortschr. a. d. Geb. d. Röntgenstrahlen **83:** 330–342, September 1955. (In German)

In the German literature, high-voltage radiography of the chest has been recommended chiefly as a special procedure to be employed only under certain circumstances (diminished radiotranslucency, etc.). The authors have taken over 1,000 chest films for the purpose of comparing the results of the various high-voltage technics with those obtained with the usual low-voltage procedures in routine chest radiography. The following high-voltage technics were used, with some modifications based on the sensitivity of the film emulsion, the speed of the screens, and the dimensions of the patient.

1. 110 to 125 kv; 3 mas; focal spot-film distance (FFD) 150 cm., plus 4 cm. (for the Bucky); high-speed Bucky, with a grid ratio of 7:1.

2. 150 kv; 1.5 mas; FFD 150 plus 4 cm.; high-speed Bucky, 7:1.

3. The "Groedel technic": 300 cm. distance from focal spot to the back of the patient and then another 15 cm. (to diminish secondary radiation) from the front of the patient to the film; 120 kv; no Bucky.

One of the greatest advantages of high-voltage radiography is the fact that, as a result of the higher penetration, all gradations of radiodensity of the various structures of the chest can be brought out on a single film, while with the low voltages special Bucky films are often necessary to penetrate certain dense areas. The trachea, the large bronchi, and cavities within dense lung structure can be well demonstrated, without loss of detail in the less dense areas of the lungs. This is particularly obvious in the lateral projections. Other advantages are the much shorter exposure time, minimizing the effect of motion in the area around the heart, and the increase in detail due to the possibility of using the slower detail screens. The difference in contrast in bone and soft tissues is diminished, which allows good visualization of foci behind the clavicle and the ribs. A further improvement can be obtained by using non-screen films in cassettes with detail screens.

On the basis of their observations, the authors believe that high-voltage radiography embodies enough advantages to justify its acceptance as the standard technic for chest radiography.

Sixteen roentgenograms; 1 table.

WILLIAM A. MARSHALL, M.D.
Chicago, Ill.

A Method of General Anesthesia for Bronchoscopy and Bronchography. Sylvan M. Shane and Harry Ashman. Arch. Otolaryng. **62:** 319–321, September 1955.

A method of general anesthesia for bronchoscopy and bronchography, which is considered superior to procedures previously employed, is described. Following preliminary anesthetization with hexobarbital or thiopental, a mixture of nitrous oxide, oxygen, and cyclopropane is used. After induction of Plane 1 anesthesia with the use of a rubber anesthesia mask, respiration is briefly arrested by injection of succinylcholine and the flow of gases is then resumed through the bronchoscope for bronchoscopy or through an endotracheal tube for bronchography. By a continuous flow of gases, the patient is kept under an even plane of light anesthesia. The authors list the following advantages: The method is safe; the plane of anesthesia does not fluctuate; ether is not used, regardless of age; bronchoscopy and bronchography may be carried out for indefinite periods of time without the necessity for speed on the part of the surgeon, and without apprehension on the part of the patient; patients are fully awake within three to seven minutes of terminating the anesthesia; the danger of toxic reactions associated with local analgesia is obviated; the method is applicable to all age groups.

One photograph.

The Significance of the Lateral Subsegments of the Lung in Pulmonary Disease. A Review of 500 Cases. L. Di Guglielmo and B. Bonomo. Acta radiol. **44:** 217–229, September 1955.

The lateral regions of the lungs have particular significance in pulmonary disease, and are frequently seen to be the seat of morbid processes. These areas often appear as fairly definite segments, with certain relatively constant anatomic features.

In the right upper lobe, in addition to apical, anterior, and posterior segments, there is an additional lateral (axillary) segment in about 10 to 18 per cent of cases. This is supplied by a fourth autonomous, usually single, segmental bronchus. Consolidation in this segment appears on a postero-anterior radiograph as a triangular opacity, below the level of the clavicle, with

its apex pointing toward the hilus, its base in contact with the lateral chest wall, and its lower border coinciding with the horizontal fissure. On the lateral projection, the opacity is centrally situated, appears triangular or quadrangular, with its lower border riding on the point where the horizontal and oblique fissures meet, being formed posteriorly by the upper part of the oblique fissure and anteriorly by the horizontal fissure.

The lateral segment of the middle lobe, which always has an autonomous lateral bronchus, also presents a characteristic appearance when consolidated. On the lateral view the opacity is triangular with the apex pointing toward the hilus and the base directed forward. Its upper and lower borders are formed by the horizontal and oblique fissures. On the postero-anterior projection, the segment appears triangular and frankly external.

On the left side, the lateral subsegment of the lingula is similar to that of the right middle lobe, except that in the absence of a horizontal fissure, the upper margin is less definite.

The lateral region of the base of the lower lobe is frequently the seat of disease, and lesions here have well defined roentgen features. On a postero-anterior film, the opacity is triangular, and extends from the hilus to the lateral chest wall. It is separated from the diaphragm by normally radiolucent lung tissue. On the lateral view the process is seen centrally, below the hilus, sparing the apex of the lower lobe. Its anterior superior margin is formed by the oblique fissure.

Five hundred cases of segmental lung disease were reviewed in connection with this study. Eleven per cent of the upper lobe lesions were laterally situated, as were 4.9 per cent of the middle lobe cases and 7.1 per cent of the lower lobe cases. Of the 500 patients, 459 had disease restricted to one segment, while the remainder showed involvement of 2 or more segments.

Sixteen roentgenograms; 8 drawings.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

The Significance of the Anterior Segment in Bronchiectasis. Richard H. Overholt and Wilford B. Neptune. J. Thoracic Surg. **30:** 288–298, September 1955.

A study of more than 1,450 cases of bronchiectasis revealed that at least 8 per cent of patients have disease in the anterior segment. In several patients with definite symptoms, this was the only segment involved. It is unfortunate that most bronchographic technics are designed primarily to fill the basilar segments, the middle lobe and lingula, with acceptance of an inadequate upper lobe pattern. Unless some of the instillation of contrast medium is done with the patient in the lateral recumbent and prone positions, the upper anterior quadrants are often poorly demonstrated.

The amount of disease shown bronchographically is not always an index of the severity of the symptoms produced. Dependency of the dilated bronchus has more influence on clinical behavior than the extent of structural alteration.

Complete mapping of all segments as a preliminary step in evaluating any bronchiectatic patient for surgery is of importance. On rare occasions the anterior segment may be the only abnormal area; the most frequent finding will be middle lobe (or lingula) disease in combination with involvement of the anterior segment. In these instances, the anterior segment, or particularly the inferior subsegment, usually passes forward and downward, with the distal portion in a dependent position similar to the middle lobe segments. Clockwise rotation of the anterior segment following resection of the middle lobe, lingula, or basal segment brings it into a dependent position. Minimal preexisting abnormality is then likely to become a process of pathologic significance. Failure of adequate preoperative evaluation may deny these patients a chance for cure or it may necessitate future surgery to alleviate persistent symptoms.

Two cases in which failure to recognize disease in the anterior segment resulted in persistence of symptoms after incomplete surgery are reported.

The authors discuss in detail, with illustrations, the technic of removal of the right and left anterior segments individually or in combination with adjoining segments.

Nine roentgenograms; 5 drawings.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

Pathology of Carcinoma of the Lung as Related to the Roentgen Shadow. Averill A. Liebow. Am. J. Roentgenol. **74:** 383–401, September 1955.

This paper, which is part of a symposium on pulmonary cancer (see the three following abstracts), is a general review of the subject, with a brief analysis of the pathology of the various types of carcinoma as related to the roentgen shadow.

Anatomically, the blood supply of cancers is from the bronchial and not from the pulmonary arteries, but the latter may be displaced by the tumor. Lymph nodes may be enlarged as a result of inflammation, and their demonstration is not necessarily indicative of a poor prognosis.

The following classification of malignant epithelial tumors of the lung is offered.

A. Bronchogenic carcinoma
   Epidermoid carcinoma
   Anaplastic carcinoma
   Adenocarcinoma
   Mixed
B. Bronchiolar carcinoma
C. Bronchial adenoma
   Carcinoid type
   Cylindromatous or adenocystic type
   Others

Epidermoid carcinomas comprise 45 to 65 per cent of all bronchogenic tumors. Histologically, these vary in their degree of differentiation. Grossly, they are most commonly pear-shaped. The location may be central or peripheral. They may grow into the lumen or around it. If the tumor is in the apex, it may produce a Horner's syndrome (Pancoast tumors). Necrosis is common, especially with well differentiated squamous-cell carcinomas. Growth may be slow and lymphatic extension is late. Prognosis is good in the absence of lymph node involvement (63.2 per cent five-year survivals). With disease of the lymph nodes, the five-year cure rate drops to 25 per cent.

Anaplastic carcinomas (*oat-cell*) occur in a younger age group. The usual location is central, especially in the stem bronchi. Spread is primarily lymphatic, and there may be massive involvement of the nodes. Cavitation is unusual. The prognosis is poor.

Adenocarcinoma is the commonest type of lung cancer in females. The site is likely to be peripheral. Cavi-

ties more than 2 cm. in diameter are unusual, and involvement of the chest wall is rare. Growth is relatively rapid. Hematogenous spread is early and extensive.

Bronchiolar carcinoma ("alveolar-cell carcinoma"; "pulmonary adenomatosis") arises in the bronchioles rather than in the alveoli. The incidence is equal in males and females. Histologically, the lesions are pleomorphic. Although calcification in the form of psammoma bodies occurs in 50 per cent of the cases, it is not visible roentgenographically. The degree of differentiation does not influence the prognosis. Grossly, there are two types: (1) the more common discrete nodular or tumor-like type; (2) the diffuse or pneumonia-like form. Spread is by the lymphatics and possibly by aspiration. There is also a possibility of multiple foci of origin. Respiratory failure is the usual cause of death. The prognosis is poor.

Adenomas are of two main types, the cylindroma and the carcinoid. The cylindroma has a more central location and is likely to involve the trachea and main bronchi in the region of the carina. Thirty-two per cent of these tumors metastasize. The carcinoids have a better prognosis, with metastasis in only 9.5 per cent. Treatment of either type by local surgery is quite successful and, even if total removal is not possible, successful palliation may be achieved. The presence of metastasis does not indicate a poor prognosis and life may go on for many years. It seems unwise, in view of the peculiarities of these tumors, to call them either bronchial adenomas or carcinomas. Better terms are bronchial cylindroma and bronchial carcinoid.

Sixteen roentgenograms; 1 photomicrograph; 13 photographs.

PAUL MASSIK, M.D.
Quincy, Mass.

The Detection of Carcinoma of the Lung by Screening Procedures, Particularly Photofluorography. L. H. Garland. Am. J. Roentgenol. **74:** 402–414, September 1955.

The author is not optimistic as to the role of screening methods in the solution of the lung cancer problem. The average yield in general population surveys has been about 10 carcinomas per 100,000 persons examined. The most commonly used procedure is one employing single anterior exposures made in full inspiration on 70-mm. film. The size of the film has been shown, however, to be of minor importance. The three most important factors are correct technic, careful interpretation, and dual reading.

The following types of lesions are listed as most commonly overlooked in minifilm surveys: (1) densities less than 2 cm. in diameter; (2) densities in the peripheral portions of the lung; (3) densities lying behind bony or soft-tissue structures, especially close to the mediastinum and at the bases; (4) partly obstructive lesions with local emphysema (visible only in expiratory films); (5) densities marked by associated pneumonitis, tuberculosis, or cavitation.

The gross morphologic types of bronchogenic carcinoma recordable on photofluorograms depend on the size and location of the tumor, and the presence or absence of associated pulmonary collapse, infection, adenopathy, or pleural effusion. Direct evidence of the *tumor* itself is recordable when it presents as a visible mass partly or completely surrounded by air-bearing parenchyma. It may show central necrosis with cavitation. Indirect evidence of the tumor is manifest by disturbed bronchial function (with secondary infection or *pneumonitis*), partial bronchial blockage (with obstructive *emphysema*), and complete bronchial blockage (with *atelectasis*). *Adenopathy* or *pleural effusion* may be the first manifestation.

The proportion of "tumor suspects" detected in surveys who actually prove to have primary lung cancer varies in different series. The figure is approximately 8 per cent. Twenty-two to 60 per cent of the tumors detected have proved to be resectable. In general, however, the short-term curability rate for survey-detected cases is only slightly better than for cases diagnosed clinically.

The scope of the problem is indicated in the following quotation from the author's summary: "There are some 22 million males in this age group [over forty-five] in the United States. Semi-annual examinations, using three views (inspiration and expiration frontal and inspiration lateral) would involve some 132 million minifilms *annually*, plus the necessary million or so standard or other size films required for checking those with 'tumor suspect' minifilms each year. The psychologic problem of maintaining the continued interest of qualified readers in a program of this scope baffles the imagination."

One graph; 11 tables.

PAUL MASSIK, M.D.
Quincy, Mass.

The Roentgen Signs of Carcinoma of the Lung. Leo G. Rigler. Am. J. Roentgenol. **74:** 415–428, September 1955.

Though recognizing the limitations of roentgen examination in the determination of the exact nature of a disease process, the author has found certain roentgenologic signs so characteristic of malignant tumors of the lung that they carry "almost the same weight as the more positive finding of actual cells, whether in the biopsy specimen or in the sputum." He lists eleven signs and discusses each at some length:

(1) The appearance of a solitary pulmonary shadow not present in previous films, especially in a person past middle age.

(2) Increase in size of a previously demonstrated peripheral nodule or mass.

(3) Absence of calcification. Though this is, admittedly, of little definite significance in itself, the presence of calcification is very strongly against cancer.

(4) Notching or umbilication of the margin of cancer, single or multiple, best seen in laminagrams.

(5) Enlargement of one hilar area. This should be followed by laminagrams to demonstrate the major bronchi and to determine the presence of enlarged lymph nodes.

(6) Increasing infiltration of a beaded or nodular character.

(7) Pneumonic lesions which (*a*) fail to resolve, (*b*) have a nodular appearance, and (*c*) are associated with bronchostenosis (determined bronchographically).

(8) Thick-walled cavities with irregular nodular inner walls.

(9) Segmental, lobar, or unilateral emphysema.

(10) Atelectasis.

(11) Changes in the lumen of bronchi, usually best demonstrated by laminagrams. It may be possible to demonstrate the tumor within the bronchus.

Twenty-two roentgenograms.

PAUL MASSIK, M.D.
Quincy, Mass.

Surgical Procedures in the Diagnosis and Treatment of Bronchogenic Carcinoma. Edgar W. Davis, Sol Katz, and J. Winthrop Peabody, Jr. Am. J. Roentgenol. **74:** 429–436, September 1955.

Delay in the diagnosis of cancer of the lung is due in part to a general misconception of its nature and the indifference of patients and physicians to early minor symptoms. The chief deterrent to earlier recognition is the popular belief that pulmonary cancer is a debilitating disease of old men manifesting itself by a constant cough, severe chest pain, frequent hemoptyses, progressive dyspnea, hoarseness, and marked wasting. By the time these symptoms have appeared, only 10 per cent of the cases are theoretically curable. Actually, less than 8 per cent of the patients will survive five years.

The most valuable single diagnostic aid is a properly interpreted roentgenogram. A wider use of chest survey films will result in the discovery of cases in the asymptomatic phase of disease when the percentage of cure is highest. However, the employment of survey methods does not free one from the obligation of thoroughly investigating early pulmonary symptoms.

Even after a full analysis of early symptoms and the discovery of a lesion of indeterminate character, the differential diagnosis cannot be established without resort to surgical or semisurgical procedures, as bronchoscopy, lymph-node biopsy, aspiration biopsy, cytological study of bronchial secretions and pleural fluid, pleural biopsy, and exploratory thoracotomy.

Bronchoscopy is the most important diagnostic procedure short of thoracotomy for a definitive diagnosis. It permits direct inspection of the lesion in about half of all cases. Eighty per cent of the squamous and small-cell bronchogenic carcinomas, which have a predilection for large bronchi, can be diagnosed by this procedure. Adenocarcinoma, on the other hand, which affects predominantly the peripheral bronchi, can be visualized in only 38 per cent of the cases. Large-cell bronchogenic carcinoma, which occurs with equal frequency in both large and small bronchi, can be visualized in 50 per cent of the cases.

The diagnosis of bronchogenic carcinoma has been enhanced by a study of exfoliated cells in the sputum and bronchial secretions. The collection of bronchial secretions has certain advantages over sputum collection, but the ease and frequency with which sputum can be obtained tend to compensate for some of the disadvantages. Positive findings have been reported in 30 to 90 per cent of cases so studied.

Lymph node biopsy should be done if the character of the pulmonary lesion is indeterminate. The most commonly involved nodes are found in the supraclavicular and axillary areas. So-called scalene-node biopsy is a worthwhile addition to the usual diagnostic procedures. It may be useful in arriving at a histologic diagnosis and making a decision in a case of doubtful resectability. In poor risk patients, the presence of scalene lymph node involvement would preclude the employment of curative extirpative surgery.

Most thoracic surgeons believe that aspiration biopsy is contraindicated in presumably operable cases because of possible complications. However, in patients with apparently inoperable cancer or in patients in whom surgery is contraindicated, the use of needle biopsy to establish the diagnosis is justifiable.

A study of the pleural fluid may enable a diagnosis to be reached in about 50 per cent of the cases. The presence of massive bloody pleural effusion containing malignant cells usually precludes surgical procedures with either a curative or palliative intent.

Pleural biopsy is a safe diagnostic procedure with little attendant morbidity and may permit a histologic diagnosis. If it proves positive for carcinoma, resection or palliative procedures are not indicated.

Exploratory thoracotomy should be employed when diagnosis is impossible by the use of the various measures outlined above. It is the only means of making a histologic diagnosis in about 25 per cent of bronchogenic carcinomas involving the larger bronchi and in early peripheral lung cancer. Fifty per cent of all solitary circumscribed pulmonary lesions will prove to be malignant.

The objective in surgical treatment is complete removal of the tumor and the regionally connected lymphatics. Pneumonectomy with complete removal of the mediastinal lymph nodes is usually considered the only adequate treatment. In patients with poor pulmonary reserve or cardiac function, only lobectomy should be employed.

When exploratory thoracotomy is employed as a diagnostic measure, conservatism is advised. If a diagnosis is made by frozen section, lobectomy or pneumonectomy is done, depending upon the extent of involvement or the philosophy of the individual surgeon. Patients suffering from incurable carcinoma of the lung with severe complications may be subjected to palliative lobectomy or pneumonectomy as the surgeon's judgment dictates.

Eleven roentgenograms.

H. C. JONES, M.D.
Grand Rapids, Mich.

Sarcoidosis: An Analysis of Twenty-One Proved Cases. Alvin W. Finestone. Am. J. Roentgenol. **74:** 455–465, September 1955.

Clinical, laboratory, and roentgen findings in 21 proved cases of Boeck's sarcoid are summarized and tabulated. Positive diagnoses were obtained by biopsy of such sites as the tonsil, liver, and lung, but primarily of peripheral lymph nodes. The author states that by examination of tissue alone it may sometimes be impossible to differentiate Boeck's sarcoid from non-caseating tuberculosis, leprosy, mycoses, tularemia, lymphopathia venereum, syphilis, and beryllosis. Consequently clinical and radiological findings are important in reaching the proper diagnosis.

The most frequent roentgen finding in this study was bilateral hilar and right paratracheal adenopathy, present in 50 per cent of the cases. Thirty-five per cent showed mediastinal adenopathy alone; 40 per cent both mediastinal and lung involvement; and 25 per cent positive changes only in the lungs. Characteristic parenchymal findings were strand-like shadows, with superimposed nodular or confluent miliary patterns.

A detailed discussion of the differential diagnosis is given. The most difficult conditions to be differentiated are chronic lymphatic leukemia, lymphosarcoma, and Hodgkin's disease. Patients with any of these diseases ordinarily are relatively sick, while symptoms in sarcoidosis are frequently minimal. Helpful laboratory findings include elevation of serum proteins and globulin in sarcoidosis. Pleural or pericardial effusion favors malignant disease.

Twenty-five roentgenograms; 6 tables.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Report on a Fluoroscopic Chest Survey in China (Canton), January 1948 to February 1949. R. M. Chadwick, R. Tak Eng, and S. C. Lee. Am. Rev. Tuberc. **72:** 356–366, September 1955.

The authors report a fluoroscopic chest survey conducted by a private clinic in Canton, China. A total of 40,858 subjects were examined. Since most of them were from schools and universities, over 85 per cent of the subjects were between the ages of eleven and twenty-five years. Canton has always been known to have a high tuberculosis rate and this was borne out by the incidence of 2.62 per cent found in the survey. Nearly 80 per cent of those who had suspicious lesions fluoroscopically were found to have significant tuberculosis on subsequent examination with 14 × 17-inch chest roentgenograms. The findings could not be confirmed by bacteriologic studies or follow-up films, because of lack of facilities.

The survey was not a fair sampling of the city population, because most of the subjects were from private schools attended by middle and upper income groups and most of them were in the younger age groups. It is likely that a more representative sampling would have shown a still higher incidence. The range observed was from 0.95 per cent in the eleven- to fifteen-year age group to 15.30 per cent between the ages of fifty-one and seventy-five.

No tuberculin testing was done prior to fluoroscopy because of the high incidence of positives known to exist in Canton. Admittedly, a survey using some type of film would be superior to fluoroscopy, but funds and facilities were lacking. In addition to the tuberculosis, a number of cardiovascular and bony abnormalities were found. The authors feel that the incidence of tuberculosis is so high in China that tuberculin testing before roentgenographic surveys is of no value as far as economy of case-finding is concerned.

Eight tables. JOHN H. JUHL, M.D.
University of Wisconsin

Roentgenological Observations on Pleuropulmonary Tularemia. Joseph McK. Ivie. Am. J. Roentgenol. **74:** 466–471, September 1955.

Because untreated tularemic pneumonia carries a high mortality and because an almost specific antibiotic (Streptomycin) is now available for treatment of this disease, it is becoming increasingly important that accurate diagnosis be made. This report summarizes clinical, laboratory, and radiologic findings in 16 cases of proved tularemia, in a search for diagnostic roentgen features. The diagnostic problems are enhanced by the fact that fully half of the cases present no ulceroglandular lesions.

Of 34 proved cases of tularemia, one-third showed pulmonary involvement. The most common roentgen finding was an oval area of parenchymal infiltration indicative of lobular pneumonia. The zone of involvement tended to be well circumscribed and clear-cut, suggesting in its appearance a lung abscess before the occurrence of cavitation or break-down. Most cases subsequently showed adjacent pleural involvement with pleural effusion. Although none of the chest film findings are pathognomonic, the oval area of infiltration is noteworthy. If ipsilateral hilar adenopathy is associated, the diagnosis becomes more certain. Contrary to some previous teachings, hilar adenopathy was not a commonly associated finding in this series, although it did occur in 5 cases.

Six cases are reported in considerable detail. All showed rapid improvement once the proper diagnosis was made and treatment with Streptomycin instituted.

Eight roentgenograms. JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Histoplasmosis. Frederic N. Silverman, Jan Schwarz, M. Eugene Lahey, and Robert P. Carson. Am. J. Med. **19:** 410–459, September 1955.

In this review the authors have attempted "to sift and organize the available information on histoplasmosis, to elucidate still existent problems, and to report 7 new proved cases illustrating the variability of the clinical picture." A section on the radiological aspects is included. While roentgen examination of the chest is one of the most important means of calling attention to the frequency of histoplasmosis in certain geographic areas, there are, except for the disseminated intrathoracic calcifications, no features which permit clear differentiation from other pulmonary inflammatory disease.

The bibliography of 216 references indicates the scope of the paper.

Thirty-eight illustrations, including 8 roentgenograms.

Chronic Pulmonary Disease in Histoplasmin Reactors. A Review of 229 Cases Discovered Through Chest Clinic Examinations. F. Clark White. Am. Rev. Tuberc. **72:** 274–296, September 1955.

A long-term study of chronic pulmonary disease in histoplasmin reactors was conducted in a tuberculosis chest clinic and hospital. The observation period ranged from five to twenty-five years, and a total of 229 cases were studied. There were 123 tuberculin-negative patients; of these, 53 gave a history of definite exposure to dust near the habitat of domestic fowl or pigeons, to threshing dust, or to dust raised in handling raw wool or fleeces. There was wide occupational diversity, but nearly one-half of the number (51) were from rural areas.

There were two main groupings on the basis of roentgenographic findings: disseminated widely scattered shadows and localized disease in which the shadows were single or at least not widely distributed. Pleural effusion alone was noted in 2 cases and in association with pulmonary disease in 7 cases. Hilar node enlargement was the sole manifestation in 1 instance. Eighty-one patients had non-disseminated and 39 had disseminated disease.

In 34 cases a detailed analysis of chest films was made, from the onset to the stage of pulmonary calcification. Initially the infiltrate appeared irregularly mottled. In general, these mottled shadows decreased in size and became nodular in a period of a month to twenty months, but in 7 patients they persisted for more than two years. The nodules then gradually shrank and became spherical or ovoid, with evidence of beginning calcification after three to fifteen years. The calcification was central, and the soft-tissue density around it tended to clear over a long period of time—from six to thirteen years. In only 4 patients in the entire group studied did cavitation develop. There was found to be remarkable similarity in the changes observed roentgenographically in each individual pulmonary lesion.

Clinical manifestations were mild in the non-disseminated disease. They consisted of cough, lassitude,

chest pain, expectoration, fever, weight loss, hemoptysis, dyspnea, wheezing, chills, anorexia, and aching pain, and disappeared completely in over one-half of the patients within six weeks. In the disseminated disease, the symptoms were much the same, but were more severe, and additional symptoms of headache, nausea, vomiting, dizziness, diarrhea, epigastric distress, and a generalized pustular eruption were encountered. In both types, the cough was non-productive at first, but was followed by expectoration of thick tenacious sputum in four to seven days. In general, the disease was mild and self-limited, with only 7 patients suffering relapses.

Microbiologic studies are also reported and discussed.

Ten roentgenograms; 6 tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Eosinophilic Granuloma (Honeycomb Lung) with Diabetes Insipidus. L. J. Grant and Jean Ginsberg. Lancet **2**: 529–532, Sept. 10, 1955.

A case of honeycomb lung associated with diabetes insipidus is reported, and the etiological factors are discussed. The patient was a thirty-two-year-old man, with a productive cough, polydipsia and polyuria, and increasing breathlessness.

A chest radiograph two years prior to admission had shown a reticular pattern throughout both lungs, more definite in the right upper and left lower zones. In the chest film taken on admission, this reticular pattern was coarser and more clearly defined and cysts were evident in the left upper lobe. Tomograms disclosed cystic changes throughout both lungs, some of the cysts measuring as much as 3 to 5 cm. in diameter. Bronchography of the right lung revealed a normal bronchial pattern with no evidence of bronchiectasis. In the left lung, the peripheral bronchi were incompletely filled.

The diagnosis of honeycomb lung is radiological and may be tentatively made from a plain postero-anterior film, though it requires confirmation by tomography. The cysts are particularly well visualized after spontaneous pneumothorax, a frequent complication. Bronchograms are normal; presumably the small size of the bronchial communications prevents iodized oil from entering the cysts, some of which have been shown histologically to be in communication with the bronchi.

In the case reported, lung biopsy showed the underlying lesion to be an eosinophilic granuloma. The therapeutic possibilities, including irradiation, are discussed. It is considered somewhat hazardous, however, to subject the lungs to a process which might include further fibrosis as part of its intrinsic effect on the parenchyma. Encouraging results have been observed to follow the early use of corticotrophin.

One roentgenogram; 3 photomicrographs.

Pulmonary Arteriovenous Fistulas. Walter J. Stork. Am. J. Roentgenol. **74**: 441–454, September 1955.

Pulmonary arteriovenous fistulas may be either congenital or acquired. The symptoms, aside from clubbing of the fingers and toes, are due to chronic anoxemia, with resultant polycythemia. Among these are dyspnea, numbness, fainting, diplopia, thick speech, hemoptysis, epistaxis, emesis, and chest pain. A continuous murmur may be heard over the lesion and percussion may reveal dulness at its site.

Anatomically the lung lesion consists of angiomatous malformations with arteriovenous anastomoses. Pathological studies show a thin-walled vascular sac which consists of a distended afferent artery and distended efferent veins. Ruptures may occur within the lesion or new channels may arise and increase the circulatory disturbance.

The most common sites of pulmonary arteriovenous fistulas are between the lobules, along the intralobular and bronchovascular bundle, and below the interlobar and mediastinal pleura.

The cardinal roentgen manifestations are one or more opacities on either or both sides, more often in the lower lobes, most commonly connected with the hilar structures by at least two band-like communicating densities, and the invariable pulsation and increased density of the hilar structures on the involved side. Not all of these features may be demonstrable in a given case.

Pulmonary fistulas must be differentiated from small cysts, mesotheliomas, hernia of the diaphragm, pulmonary infarct, unresolved pneumonia, bronchiectasis, pulmonary artery aneurysm, ball-shaped infiltration of tuberculosis, hamartomas, pulmonary adenomas, lung carcinomas, and coccidioidomycosis. The differential diagnosis of each of these conditions is discussed in considerable detail.

Additional valuable diagnostic information may be obtained by the use of overexposed films, multiple projections, laminagraphic studies, cardiac catheterization, and angiocardiography. In connection with fluoroscopy and radiography useful data may be obtained by employing the Valsalva and Müller maneuvers. Angiocardiography will usually show the number of lesions, as well as their size and distribution, and should be done before the patient is subjected to surgery. In more than 50 per cent of cases two or more lesions have been found.

Seven case reports are submitted. Notching of the ribs was noted in 2 patients but was considered an incidental finding. A coexisting communicating hemangioma of the liver was present in 1 case.

Twenty-four roentgenograms illustrating pulmonary arteriovenous fistulas or lesions with which they might be confused accompany the text.

H. C. JONES, M.D.
Grand Rapids, Mich.

Mediastinal Tumors of Thyroid Origin. J. L. Ehrenhaft and Joseph A. Buckwalter. Arch. Surg. **71**: 347–356, September 1955.

Masses of thyroid origin not uncommonly extend into the retrosternal mediastinal space. This paper is concerned only with those thyroid masses in which the main bulk of the tumor is located below the thoracic inlet and within the mediastinum. It is based upon 13 cases which have been proved by surgery.

Of different studies employed in arriving at a preoperative diagnosis, the most helpful was routine roentgenography in postero-anterior, lateral, and oblique projections. Bronchography, esophagography, and planigraphy were of aid in certain cases. None of these procedures, however, indicates the nature of the tumor. This can be determined only by a radioactive iodine survey but, since most of the intrathoracic tumors will have undergone extensive degenerative changes, uptake is obtained only in an occasional patient.

The various positions of mediastinal goiters are

illustrated. The authors prefer the anterior sternum-splitting thoracotomy for anterior mediastinal masses or the right lateral thoracotomy for mid and posterior mediastinal thyroid tumors.

Ten roentgenograms; 4 photomicrographs; 2 photographs; 13 drawings; 2 tables.

JULIAN S. LEWIS, M.D.
Cleveland City Hospital

Malignant Thymoma Associated with Myasthenia Gravis. Charles R. Ream and Alfred M. Beyer. Am. Rev. Tuberc. **72**: 381–385, September 1955.

It has been reported that 50 to 75 per cent of patients with myasthenia gravis have enlargement of the thymus and that 15 per cent of patients with thymomas have myasthenia gravis. The association of malignant thymoma with myasthenia gravis is rare, however. Of a published total of 266 malignant thymic tumors, only 5 were accompanied by myasthenia gravis.

In the case reported in this paper, a left anterior mediastinal mass was demonstrated roentgenographically. It was somewhat ovoid and did not pulsate. It projected laterally about 2 to 3 cm. to the left of the left heart border. At surgery the mass was found to be well encapsulated and slightly adherent to the anterolateral aspects of the pericardium. Its upper pole was adherent to the thoracic duct. Histopathologic examination showed a malignant thymoma of the lympho-epithelioma type.

The patient had had symptoms of bulbar myasthenia gravis for six weeks before admission, consisting of difficulty in masticating and swallowing and inability to close her mouth. Following surgery, the symptoms largely disappeared and no further treatment with neostigmine was necessary during a nine-month follow-up period. The only remaining symptom at the end of that time was an occasional slight weakness in the jaw.

Three roentgenograms.

JOHN H. JUHL, M.D.
University of Wisconsin

THE CARDIOVASCULAR SYSTEM

Mitral Valve Disease and Mitral Valvotomy. J. F. Goodwin, J. D. Hunter, W. P. Cleland, L. G. Davies, and R. E. Steiner. Brit. M. J. **2**: 573–585, Sept. 3, 1955.

Preoperative studies, operative findings, and postoperative courses of 75 persons undergoing mitral valvotomy are presented. The mass of detail makes impossible an adequate abstract of the observations reported.

Radiological evidence of severe pulmonary hypertension (dilated proximal pulmonary arteries with narrowed, tortuous distal branches) proved to be associated with marked stenosis. Hemosiderosis and costophrenic septal (Kerley's) lines were also observed with pulmonary hypertension and stenosis. The right ventricle was enlarged in all except 13 patients, while the left ventricle was enlarged only in patients with associated aortic disease and in one with systemic hypertension. Calcification was demonstrated in 18 patients and was found in 10 others, in slight degree, at operation.

Once the diagnosis of mitral stenosis is made, it should be determined that it is advanced enough to be disabling but not to the extent that it is completely irreversible, and that the valve is amenable to surgery, before valvotomy is recommended. The authors' contraindications to surgery are: severe mitral incompetence, intractable congestive failure, active rheumatic fever, and significant aortic stenosis unless one is prepared to do a combined attack on both valves.

The majority of patients were greatly improved symptomatically after operation, but in only one-third of those with good subjective results was there any objective evidence of improvement. Pulmonary vascular disease, assessed radiologically, was not altered in two-thirds of patients with a good result, suggesting that valvotomy, although it may halt the changes, may fail to cause their reversion.

Nine roentgenograms; 4 electrocardiograms; 1 photograph; 4 graphs; 19 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Aortic Stenosis: A Clinical Study. M. B. Matthews, W. E. Medd, and R. Gorlin. Brit. M. J. **2**: 759–763, Sept. 24, 1955.

The recent application of the technic of valvotomy to the stenosed aortic valve led the authors to analyze a series of 50 consecutive patients with aortic stenosis to determine how best to select those suitable for surgery. Of the 50 cases, 6 were considered to be congenital, 20 were rheumatic, and 24 of undetermined origin. The series included 31 males and 19 females, with an age range from nine to seventy-six years.

Nineteen patients had either no symptoms or only slight dyspnea; 19 had moderate or severe dyspnea; only 8 had paroxysmal nocturnal dyspnea. Nineteen had some degree of angina pectoris and 7 exhibited effort syncope.

Fluoroscopically enlargement of the left ventricle was found in 44 and prominence of the first portion of the aorta in 30. In 33 there was calcification of the valve but this had no relation to the severity of the obstruction or the presence of aortic incompetence.

Electrocardiographic evidence of left ventricular strain or hypertrophy was found in most cases, especially in those with more severe stenosis.

Clinically, palpation of the pulse was not reliable except when regurgitation was also present. The aortic second sound was normal in 30 cases; there was correlation between valve calcification and diminution or absence of the second sound. Thirty-seven patients had a systolic thrill; it tended to be absent in those with cardiac failure.

Recordings of brachial artery pulse pressure curves in all but 2 of 39 patients showed an increase in systolic uptake time. Cardiac catheterization was done in some of the patients but was considered of no value as a routine measure.

Aortic stenosis contrasts with mitral stenosis in its natural history. A long symptomless period is followed by a rather rapid downhill course once failure begins, while mitral patients may produce severe symptoms over a long period.

The ideal patient for surgery on the basis of this study would be the young or middle-aged woman with severe symptoms and an uncalcified valve. Most patients, however, do not have severe symptoms until too late for surgery and they are not likely to agree to what is still an experimental procedure with a fairly high mortality. Long-term benefits are still unknown.

Seven illustrations; 5 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Congenital Aneurysm of the Right Aortic Sinus Associated with Coarctation of the Aorta and Subacute Bacterial Endocarditis. Ante-Mortem Report of a Case. Israel Steinberg and Nathaniel Finby. New England J. Med. **253:** 549–552, Sept. 29, 1955.

Fifteen cases of unruptured aneurysm of the aortic sinus (of Valsalva) diagnosed during life have been previously reported from the New York Hospital-Cornell Medical Center. Six were congenital (3 associated with coarctation of the aorta and 3 with arachnodactyly) and 9 were acquired (syphilitic). The authors present a sixteenth case, associated with subacute bacterial endocarditis, aortic regurgitation, and coarctation.

Angiocardiography in a 27-year-old woman with a history of previous treatment for subacute bacterial endocarditis demonstrated coarctation, and also a saccular aneurysm of the right aortic sinus measuring 2.2 cm. in diameter. The patient was given intensive penicillin therapy and was later operated upon. The coarcted segment of the aorta was excised. The pulsatile aneurysm was found at the root of the aorta, bulging into the right ventricle, but was not repaired because of the presence of severe aortic regurgitation.

The authors point out that congenital aortic sinus aneurysms are paper-thin and have a tendency to rupture into the structures of the right side of the heart. They therefore advocate surgery, in uncomplicated cases, through the right cardiac chambers.

Three roentgenograms; 1 diagram.

ARTHUR S. TUCKER, M.D.
Cleveland Clinic

Congenital Absence of the Left Pulmonary Artery. Stuart C. Alexander, Steven J. Figiel, and Robert N. Class. Am. Heart J. **50:** 465–470, September 1955.

The authors report a case of congenital absence of the left pulmonary artery suspected on clinical and routine roentgenologic examination and later confirmed by angiocardiography.

The patient was a 21-year-old white male originally seen because of an acute upper respiratory infection with associated cough. A 70-mm. photoroentgenogram demonstrated marked radiolucency of the left lung. Further chest films showed the left hemithorax to be smaller than the right, with narrowing of the intercostal spaces and marked increase in the radiolucency of the entire left lung. The usual shadow of the left main pulmonary vessel was not visible and there was generalized diminution of vascular markings in the left lung field. The heart and mediastinum were shifted slightly to the left. Both leaves of the diaphragm were normal in position. Chest fluoroscopy confirmed the absence of the left hilar shadow and revealed normal diaphragmatic excursion, with no mediastinal shift with respiration.

Questioning of the patient revealed that at fourteen months of age he had pneumonia involving the left lung, complicated by empyema necessitating surgical drainage. At the ages of four years and seven years he had experienced uncomplicated attacks of "pneumonia," again on the left. His exercise tolerance had always been low.

Angiocardiography was performed, with film exposures at four and six seconds, confirming the absence of the left pulmonary artery.

Two roentgenograms. THEODORE E. KEATS, M.D.
University of California, S.F.

Thrombosis of Pulmonary Arteries. D. R. Keating. Am. J. Surg. **90:** 447–452, September 1955.

Massive organized thrombosis of the main pulmonary artery and its branches has long been recognized as a pathological entity, but only recently has its antemortem diagnosis become possible. Some 100 cases of this syndrome appear in the literature, including 7 cases previously reported by the author and his associates (Am. J. Roentgenol. **69:** 208, 1953. Abst. in Radiology **61:** 964, 1953). Four cases are recorded in the present paper: 2 which were included in the earlier series, 1 additional case with autopsy confirmation, and 1 case diagnosed by angiography but not proved anatomically.

It is possible for large thrombi to exist in the main pulmonary artery and its branches for long periods of time. Often they become organized and recanalized, as in the author's case in which angiography was done. The thrombi may arise locally, as in atherosclerosis, or may be the result of small emboli originating in the systemic veins.

Symptoms and signs are those of heart failure, dominated by dyspnea and ankle edema. Clubbing and cyanosis were uncommon in the author's patients, and polycythemia was not the rule. Death was sudden.

Electrocardiograms may be expected to show right axis deviation. Also, a change may occur from left to right axis deviation with the development of cor pulmonale.

Fluoroscopy and radiography show enlargement of the pulmonary artery and main branch or branches. Pulsation of these vessels is diminished. The thrombosed vessel has a sharply outlined elliptic configuration, tapering abruptly at the distal point of closure. Beyond this, the lung segment involved shows reduced vascularity and increased radiolucency. This picture has to be differentiated from mediastinal mass lesions of variable origin, especially carcinoma with check-valve obstructive emphysema.

Six roentgenograms; 1 electrocardiogram.

WILLIAM SNOW, M.D.
Shreveport, La.

Idiopathic Dilatation of the Pulmonary Artery. F. S. P. Van Buchem, J. Nieveen, W. Marring, and L. B. Van Der Slikke. Dis. of Chest **28:** 326–336, September 1955.

Idiopathic dilatation of the pulmonary artery is to be distinguished from dilatation (1) associated with cardiac anomalies in which the pulmonary flow is markedly increased, (2) that due to increased pressure in the pulmonary artery, as in mitral stenosis, Eisenmenger's complex, etc., and (3) that occurring in combination with so-called pure pulmonary stenosis. To exclude these causes and establish the idiopathic nature of the enlargement, cardiac catheterization is essential.

In idiopathic dilatation, the systolic pressures in the right ventricle and pulmonary artery are equally high; the pressure in the right ventricle is not increased, and the oxygen saturation in the various parts of the right heart does not show significant differences. If the pressure in the right ventricle exceeds that in the pulmonary artery, even though it is in normal range, it is possible that slight pulmonary stenosis is present.

The authors state that usual x-ray methods of examination do not give reliable information about the size of the pulmonary artery. They found angiocardiog-

raphy necessary to estimate the diameter and by this means established a normal range of 22–33 mm. In cases in which the pulmonary arch was only slightly prominent, they found diameters of 62.5 and 63 mm.

Five cases of idiopathic dilatation of the pulmonary artery are presented. All showed practically the same picture: slight or no complaints, a systolic murmur in the second left intercostal space, and a more or less prominent pulmonary arch. Diagnosis was established in all by cardiac catheterization.

Fourteen roentgenograms; 3 tracings; 2 tables.

JULIAN S. LEWIS, M.D.
Cleveland City Hospital

Multiple Stenosis of the Pulmonary Arteries Associated with Pulmonary Hypertension, Diagnosed by Selective Angiocardiography. H. Arvidsson, J. Karnell, and T. Möller. Acta radiol. **44:** 209–216, September 1955.

Pulmonary hypertension caused by increased peripheral resistance to pulmonary blood flow is described in 4 patients, due in each instance to multiple stenoses in the pulmonary arteries. Heart catheterization and angiocardiography permitted the diagnosis, and also revealed post-stenotic dilatation in all of the cases. Injections were made through a catheter whose tip lay in the pulmonary trunk, so that excellent anatomic pictures of the lung arteries were obtained.

Because of their frequent situation in the smaller peripheral vascular branches, such stenoses are easily overlooked.

Seven roentgenograms.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

A Method of Angiography of the Azygos Vein and the Anterior Internal Venous Plexus of the Spine. Björn Nordenström. Acta radiol. **44:** 201–208, September 1955.

A method for angiography of the azygos system of veins is here described and illustrated. The idea was conceived when collateral veins were unintentionally demonstrated after injection of contrast medium into the leg veins of a patient whose inferior vena cava had previously been ligated.

Prior to angiographic studies, venous and arterial pressure curves after occlusion of the vena cava at different levels were made and studied.

Experiments were carried out on 13 dogs, and the procedure was apparently innocuous. The inferior vena cava was occluded below the level of the renal veins by means of a double lumen balloon catheter, and 1 c.c. contrast medium per kilo body weight was injected.

Good filling and visualization of the pelvic veins, azygos vein, and anterior internal venous plexus of the spine up to the level of the seventh cervical vertebra was obtained.

Four roentgenograms; 1 graph.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Optic Nerve Sheath and Subhyaloid Hemorrhage as a Complication of Angiocardiography. Thomas R. Hedges, Jr., and Frank B. Walsh. Arch. Ophth. **54:** 425–427, September 1955.

The authors report the occurrence of massive unilateral optic nerve sheath and intraocular subhyaloid hemorrhage during angiocardiography. The patient was a 36-year-old woman with polycythemia and congenital heart deformities consisting of interventricular septal defect, patent ductus arteriosus, truncus arteriosus, and transposition of the great vessels. Intra-arterial angiocardiography was attempted, a catheter being passed by way of the left brachial artery to the region of the aortic arch. Twenty-two cubic centimeters of 70 per cent Diodrast was then injected rapidly. Generalized convulsions and coma followed immediately. Roentgen examination revealed that the catheter was facing the right carotid artery and the contrast medium had all entered that vessel. Death ensued in three hours. No intracranial meningeal hemorrhage was found at autopsy. Posterior segments of the eyes showed profuse optic nerve sheath hemorrhage invading the subdural and subarachnoid spaces, plus massive subhyaloid and vitreous hemorrhages on the right. There was only a small amount of blood in the left subdural optic nerve space.

This case represents an unusual complication of angiocardiography. In addition, the pathological findings show dramatically that isolated optic nerve sheath and intraocular hemorrhage may take place in the absence of intracranial meningeal bleeding. Such isolated venous hemorrhages occur as a result of intracranial venous stasis when there is a rapid rise in intracranial pressure.

Three figures.

THE DIGESTIVE SYSTEM

Clinical and Radiological Correlations with Optical Esophagoscopy. Stephen J. Stempien, Angelo Dagradi, Donald M. Sanders, and Rudolph Schindler. J.A.M.A. **159:** 22–23, Sept. 3, 1955.

This paper is primarily a report of clinical experience with the optical esophagoscope (Schindler) over a period of four years, with a comparison of the results with those obtained on roentgenography. Esophagoscopy was performed 197 times in 172 patients, of whom 166 were adequately studied and followed. Studies included observation of clinical course, repeat radiological and endoscopic studies, endoscopic biopsy, surgical exploration and biopsy.

The results of esophagoscopy and roentgenography were in complete agreement in 36 cases. A group of 13 patients in whom x-ray findings were negative were found to have esophageal lesions upon endoscopic examination. Hiatus hernia, esophagitis, and varices are the conditions more frequently missed radiologically. In a group of 10 cases, esophagoscopic findings were negative, but x-ray observations, which proved to be correct, were positive. Diverticula, some varices, and small hiatal hernias may be difficult to demonstrate by esophagoscopy and may be more easily seen on the roentgenogram.

In 16 cases in which both methods yielded a positive diagnosis, the radiologic diagnosis was incorrect and esophagoscopy correct. In another group of 19 cases the x-ray examination was positive and esophagoscopy was correctly negative. Outstanding among the disagreements between the two procedures is the frequency with which a small hiatus hernia is confused with varices and esophagitis mistaken for either varices or benign cardiospasm.

Esophagoscopy proved of value in disclosing lesions in addition to those found by roentgen examination. Thus, esophagitis was found by esophagoscopy in 6

cases of hiatal hernia, 2 of benign constriction, and 2 of carcinoma, while gastritis was found on esophagoscopy in 5 patients with hiatal hernia. In another group of 9 patients, however, a radiological examination gave more reliable information than esophagoscopy. In this particular group a case of carcinoma, 4 cases of varices, 2 of cardiospasm, and 2 diverticula were not revealed by the esophagoscopic method, although attendant conditions such as esophagitis were reported. Most striking was the failure of esophagoscopy to demonstrate varices in 4 instances in which the x-ray diagnosis was correctly positive.

In 5 cases both methods failed to give a correct diagnosis. These were chiefly early varices and small hiatal hernias.

The authors feel that esophagoscopy is superior in the diagnosis of esophagitis, hemorrhagic erosions and gastritis within hernial pouches, telangiectasia, and certain cases of esophageal varices and hiatal hernia. Roentgen study may be superior in certain instances of esophageal diverticula, varices, and hiatal hernia. The two methods of examination are considered to be not in competition but complementary to each other. Both have limitations. The greatest advantage of esophagoscopy is that it permits biopsy.

One illustration; 3 tables.

F. F. RUZICKA, JR., M.D.
St. Vincent's Hospital, N. Y.

Roentgen Diagnosis of Esophageal Varices. Comparison of Roentgen and Esophagoscopic Findings in 502 Cases. I. E. Kirsh, C. C. Blackwell, and H. D. Bennett. Am. J. Roentgenol. **74:** 477–485, September 1955.

This paper is one of several reporting various aspects of an investigation undertaken for establishing the relation of Laennec's cirrhosis to esophageal varices. It presents the preliminary results of the study with special reference to the roentgen examination technic developed by one of the authors (Kirsh), roentgen diagnostic criteria, and a comparison of the roentgen and esophagoscopic findings.

A series of 502 patients having hepatomegaly, splenomegaly, or liver dysfunction without frank hepatitis were studied by roentgen examination of the esophagus and by esophagoscopy for demonstration of varices. Many of the patients had several examinations of each type. For the purposes of this report, the findings of the esophagoscopist were considered correct and the evaluation of the roentgen observations is based on this assumption. In the group of 502 patients, findings for varices were positive with both methods of examination in 66, and negative with both methods in 388. Thus the total agreement is 90 per cent. Roentgen findings were negative and esophagoscopy positive for varices in 36 cases (7 per cent); roentgen findings were positive and esophagoscopy negative in 10 cases (2 per cent).

All cases were studied by roentgenoscopy and roentgenography. Thick and thin barium mixtures were used, to which had been added a small amount of 0.25 per cent carboxymethylcellulose. Addition of this latter substance produces a more viscous medium, which adheres better to the esophageal mucosa and is thought to result in better demonstration of varices. All patients were examined in the horizontal position, with two oblique views at right angles to each other. Films were made both in inspiratory and expiratory phases and occasionally with performance of the Valsalva maneuver. Only large varices are ordinarily visible at roentgenoscopy; spot films or over-table films are important for demonstration of smaller lesions. A high kilovoltage technic was used.

The authors stress the importance of multiple projections. In several of their cases, varices were demonstrated on only one or two views, while other films suggested a normal esophagus. Peristaltic waves may completely obliterate varices, even those of large size. Thickened longitudinal mucosal folds do not mean varices. However, thickened folds with rounded expansions, best demonstrated on mucosal relief films, are important signs of varices. These may produce a beaded appearance, which must be distinguished from small air bubbles trapped in the mucosa. A scalloping of the borders of the filled esophagus is another valuable sign of varices. When these two signs are associated, they offer very strong evidence for the diagnosis of esophageal varices.

The authors feel that a careful technic will result in demonstration of important varices in almost all cases.

Seven roentgenograms; 4 tables.

JAMES W. BARBER, M.D.
Cheyenne, Wyo.

Unusual Calcification of Cricoid Cartilage Masquerading as Foreign Body in Esophagus. George S. Richardson. Arch. Otolaryng. **62:** 316–318, September 1955.

A case is presented in which a linear calcification, presumed to be in the lamina of the cricoid cartilage, masqueraded as a foreign body of the esophagus even after a 2-inch section of chicken bone had been removed at esophagoscopy. The shadow cast by the calcification persisted throughout two esophagoscopic examinations, but at no time was the chicken bone, which was responsible for the presenting symptom of throat pain, outlined or discovered roentgenographically.

Re-study of the original roentgenogram and examination of films taken after removal of the fragment facilitated correct interpretation of the shadow.

Four roentgenograms.

Pneumatosis Cystoides Intestinalis. An Incidental Finding During Therapeutic Pneumoperitoneum. Bernard Lowenstein, John W. Berry, and James H. Cuykendall. Am. Rev. Tuberc. **72:** 373–380, September 1955.

Pneumatosis cystoides intestinalis is a rare condition characterized by the presence of gas in multiple cyst-like spaces in the wall of the intestine, usually the colon or terminal ileum. The cause is unknown, but the most likely theory is that gas is forced into the bowel wall through ulcerations or abrasions, usually in the presence of obstruction. It then probably dissects to the root of the mesentery, spreading thence into various parts of the bowel. The areas most usually involved are between the beginning of the jejunum and the mid transverse colon. In adults the cysts are commonly subserosal and often occur in clusters. In children they are usually submucosal and may project into the lumen and lead to intussusception. The disease is invariably fatal in infants, with death from intestinal obstruction. Most of the cases occurring in infancy have been associated with abnormalities of the gastrointestinal tract, either congenital or acquired in the neonatal period.

The roentgenographic findings are characteristic.

The multiple accumulations of gas can be seen outside the bowel lumen and following the bowel contour. When large submucosal accumulations are present, they can cause invagination of the mucosa, narrowing the lumen in the involved area. The cysts may rupture and lead to pneumoperitoneum. Occasionally gas may dissect between the layers of the diaphragm, simulating pneumoperitoneum.

The pneumatosis in the patient reported here was noted fluoroscopically and on a chest film taken approximately a month following induction of a therapeutic pneumoperitoneum. A film of the abdomen and a gastrointestinal series, as well as a barium enema study, showed the relationship of the gas-filled spaces to the colon. The involvement was chiefly in the proximal half of the colon. The gas disappeared gradually over a period of seven months. During that time the patient had several pneumoperitoneum refills. No comment is made regarding the possible relationship of the pneumatosis to the pneumoperitoneum in this particular instance.

Seven roentgenograms. JOHN H. JUHL, M.D.
University of Wisconsin

Presentation of Two Cases of Encysted Pneumoperitoneum. J.-B. Delay. Radiol. clin. **24:** 262–266, September 1955. (In French)

Gas from a perforation in the alimentary canal may not have free access to the infradiaphragmatic regions, especially in the presence of peritoneal adhesions in a patient recently operated upon. The resulting pockets can take on a variety of shapes, often with liquid accompanying the gas and the production of fluid levels.

The first of the author's 2 cases was that of a woman who, ten days after a gastric resection, presented, on an upright study of the abdomen, a large pocket of gas and fluid anteriorly, projecting upon the spinal column just below the diaphragm. Some gas beneath the right hemidiaphragm was considered a residual from the previous operation. The mid-line pocket was thought to be due to a loop of small intestine incarcerated through the transverse mesocolon. Surgery, however, demonstrated a large abscess. At autopsy an ulceration was found on the posterior aspect of the gastric remnant just above the anastomosis. The stomach communicated with the abscess by way of this ulceration.

The second patient was a 64-year-old man, acutely ill with nausea and vomiting. Roentgen examination showed a large collection of gas and fluid anteriorly in the left iliac fossa. It was thought that this represented an encysted pneumoperitoneum originating in perforation of a sigmoid diverticulum. Autopsy, however, demonstrated a diverticulum from the second portion of the duodenum communicating with the abscess by a small perforation. The abscess had no connection with the sigmoid diverticulum.

Four roentgenograms.

CHRISTIAN V. CIMMINO, M.D.
Fredericksburg, Va.

Spontaneous Fistulas Between the Gallbladder and Gastrointestinal Tract. Everett Carlson, C. Y. Gates, and George Novacovich. Surg., Gynec. & Obst. **101:** 321–330, September 1955.

The authors report 13 cases of spontaneous fistulas between the gallbladder and the gastrointestinal tract found over a ten-year period in two hospitals with a combined population of 400 patients. In 10 cases the communication was with the duodenum, in 2 with the stomach, and in 1 with the colon. The fistulas were believed to be due to gallstones in all cases though in 1 patient a perforating duodenal ulcer may have played a part.

Six of the patients had undergone operation for gallstone ileus. In 1 case the fistula persisted for seven years following the attack of gallstone ileus despite an unobstructed common duct. If the stones causing the fistula are small, ileus may not occur, and the fistula may close spontaneously. In 2 of the authors' cases carcinoma of the gallbladder was present but was not the cause of the fistula.

Symptoms and signs were non-specific, relating either to ileus or to the underlying disease. Positive radiological findings were difficult to elicit even when the condition was suspected. In 1 case marked reflux of barium into the biliary system was noted on upper gastrointestinal examination. In 5 cases air in the biliary tree was seen on the radiographs. The gallbladder was visualized in 3 patients but this did not aid in the diagnosis of fistula.

Treatment in general is directed toward: (1) relieving gallstone ileus if present, (2) removing the diseased gallbladder and residual stones if possible, (3) closing the fistulous tract, and (4) exploring the common duct in the presence of jaundice.

Four roentgenograms. LESLIE M. ZATZ, M.D.
University of Pennsylvania

Radiographic and Other Studies of the Biliary and Pancreatic Ducts. Henry Wapshaw. Brit. J. Surg. **43:** 132–141, September 1955.

Postoperative cholangiography by injection of an opaque medium through a T-tube in place in the common bile duct was performed in a series of 56 patients, 48 with primarily biliary disorders and 8 with pancreatic disease.

Pancreatic reflux with outlining of the distal portion of the duct of Wirsung was observed 3 times in 7 cases of acute pancreatitis (42.8 per cent) and 7 times in 48 cases with biliary disease (14.5 per cent). The present series confirms previously stated opinions of the relation of pancreatic reflux to pancreatitis.

A deliberate effort was made to divert the injected medium into the pancreatic ducts by the administration of morphine. In 5 cases the drug was without effect on the bile flow; in the remaining 18 the terminal part of the common bile duct was compressed to such a degree as to resist the flow of the medium into the duodenum, regardless of the amount of pressure with which it was introduced. The hold-up lasted from four minutes to two hours. It was impossible to determine with certainty whether the morphine acted selectively on the sphincter of Oddi. It appeared more likely that the duodenal muscularis was also thrown into spasm.

Stones in the bile duct may be readily detected by cholangiography, and the usual signs are discussed. Artefacts such as air bubbles, blood clot, inspissated bile, fibrin, and organic debris must be ruled out.

None of the 7 cases of pancreatitis in the series showed any overt evidence of compression of the lower end of the common bile duct. In 1 case of annular pancreas marked stenosis of the common duct was demonstrated.

The possibility of producing an ascending cholangitis

by injection of opaque medium into the common duct is discussed and the production of acute pancreatitis by this procedure has been reported. There was only 1 minor reaction to the procedure in the present series.

Fifteen roentgenograms; 2 tables.

JOHN F. RIESSER, M.D.
Springfield, Ohio

Intravenous Cholangiography and Cholecystography. H. Stephen Weens, Jason L. Meadors, and William A. Reid. Surgery **38:** 529–538, September 1955.

The authors report their experience with the contrast medium, Cholografin, in intravenous cholangiography and cholecystography performed 48 times in 46 patients. Five of the patients had disorders entirely unrelated to the biliary tract and were considered as normal individuals; the others had symptoms compatible with biliary tract disease or proved hepatic, biliary tract, or pancreatic disease.

Side-reactions incident to the use of Cholografin were generally no more severe than those produced by agents employed for intravenous urography. Nausea and vomiting were encountered most frequently. Flushing of the skin, itching, and a peculiar taste in the mouth were also experienced by some patients. At least five minutes was taken to inject the contrast medium in 36 patients (38 examinations) and less than five minutes in 10. Five of the latter group exhibited side-reactions. All side-effects were transitory, lasting no longer than five minutes, with one exception. In this patient, who had also received blood transfusions and penicillin, itching and urticaria developed nine hours following cholangiography.

Liver-function tests performed on 42 patients before and following intravenous cholangiography revealed no impairment of hepatic function which could be attributed to the use of Cholografin.

In all normal individuals of this study, opacification of the biliary tract and gallbladder was prompt and satisfactory.

Eight patients with acute cholecystitis were examined during the early course of the disease. In none of these was it possible to opacify the gallbladder, but in 5 patients the biliary duct system could be partially or completely outlined.

Results in patients with clinical jaundice were disappointing. In only 1 of 9 patients was it possible to obtain opacification of the biliary duct system.

So far, the authors have been unable to demonstrate a stone in the common duct, although others have been able to accomplish this under favorable conditions. In 24 patients of the present series subjected to biliary tract surgery, a common duct stone was found only once. In this patient, who was jaundiced, neither the biliary duct system nor the gallbladder had been opacified on cholangiography.

The authors believe that intravenous cholangiography may prove to be a valuable method of studying the postcholecystectomy syndrome. Cholografin may produce a satisfactory cholecystogram in cases in which oral cyolecystography fails to render the gallbladder radiopaque.

Ten roentgenograms.

Advances in Cholecystography. Richard A. Elmer and J. L. Clements, Jr. J.M.A. Georgia **44:** 215–218, May 1955.

The authors discuss in a general way the gallbladder examination as it is performed in many radiographic departments, and attempt to analyze the results. Their particular interest is in duct visualization and maximum efficiency in the detection of gallstones. Three hundred and fifty-six consecutive cholecystograms were reviewed. A fairly uniform technic was employed, including films in erect and decubitus positions and serial post-fat films.

Upright and decubitus films were found to be almost equally satisfactory in obtaining good visualization of the gallbladder, free of obscuring shadows. At least one good view of this type should be included in all cholecystographic studies.

Visualization of the common duct was obtained in 42 per cent of all cases showing good concentration of the medium in the gallbladder. The duct was best seen within ten to twenty minutes after the ingestion of a fatty meal. A wide variation in the size of the common duct—from less than 4 to 11 or 12 mm.—was observed, but the size of the duct as visualized was not a true indication of disease.

In this group of 356 examinations, 240 or 65 per cent were normal, without evidence of stone. Twenty-five or 6.8 per cent showed evidence of cholelithiasis. Non-visualization or poor visualization without evidence of calculi was reported in 58 (23 per cent) and non-visualization with opaque calculi in 5 (1.4 per cent).

Four tables. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

The Reliability of Cholecystography. Ingmar G. Wickbom and Uno Rentzhog. Acta radiol. **44:** 185–200, September 1955.

Thirteen hundred and forty cholecystographic examinations were reviewed in an effort to determine whether they provided dependable information about the gallbladder and biliary tree. Practically all patients with abnormal x-ray appearances were operated upon, so that almost every case was proved. For the earlier studies a medium containing tetraiodophenolphthalein sodium was used. Later, Bilitrast (chemically similar to Priodax) was almost exclusively employed.

Results of the survey indicate that whenever gallstones are suggested by negative shadows within the contrast-filled lumen, the evidence is highly reliable.

Failure of the gallbladder to fill is almost conclusive evidence that it is diseased, if the oral ingestion of the medium was properly carried out.

If concentration is so poor that it is not possible to diagnose or rule out stones, the result is considered the same as if there were no filling. If concentration is sufficient to indicate or exclude stones, the gallbladder need not be considered abnormal.

In three-fourths of the cases with non-visualization, the gallbladder walls were found to be diseased. In one-fourth of the patients who showed good filling in a gallbladder containing stones, disease of the walls was present.

A normal cholecystogram dependably rules out disease, with very few exceptions.

The principal sources of error are: early undiagnosed pre-icteric hepatitis, which may prevent the gallbladder from filling; gastric retention of contrast medium; tumor of the biliary passages; disease of adjacent tissues.

Six tables. DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

The Use of Morphine and Propantheline in Intravenous Cholecystography. A. J. Sangster. Lancet **2**: 525–526, Sept. 10, 1955.

A technic for intravenous cholecystography with Biligrafin (Cholografin) and morphine is described. The morphine is injected intravenously thirty minutes after injection of the Biligrafin to induce spasm of the sphincter of Oddi and thus facilitate visualization of the biliary tract. Information about the integrity of the sphincter is also thereby gained. Pain incident to spasm of the sphincter was relieved by propantheline bromide. Two cases are reported.

Two roentgenograms; 2 drawings.

Cystic Duct Remnant, a Sequela of Incomplete Cholecystectomy. Frank Glenn and George Johnson, Jr. Surg., Gynec. & Obst. **101**: 331–345, September 1955.

The authors consider the term "postcholecystectomy syndrome" an unfortunate one. They believe (1) that persistent symptoms are usually due to a condition other than cholelithiasis which was not recognized or properly evaluated before operation; (2) that recurrent symptoms are often attributable to incomplete operation, with residual stones or a remnant of the gallbladder or cystic duct; (3) that the appearance of new symptoms is suggestive of injury to the common duct.

At the New York Hospital-Cornell Medical Center 35 operations were done for cystic duct remnants between 1932 and 1954. Of these, 13 were among 3,862 patients who had undergone cholecystectomy in the hospital over that period; 22 had originally been operated upon elsewhere. Salient observations on these patients are tabulated, and a number of cases are reported.

Perhaps one of the most frequent reasons for incomplete removal of the cystic duct is to be found in its anatomic variations. These are briefly discussed in the light of the operative findings. The duct remnants may be the site of acute or chronic inflammation, with or without calculi, and may be associated with common duct changes, including stones. Symptoms are not pathognomonic, but the presence of a cystic duct remnant may be suspected in any patient in whom cholecystectomy is followed by severe recurrent right upper abdominal pain, fatty food intolerance, nausea, vomiting, jaundice or fever. Common duct stones may give the same symptoms, but these are sometimes of more abrupt onset.

Patients suspected of having a cystic duct remnant should be carefully evaluated before re-operation is undertaken. Once the diagnosis is established, however, surgical therapy should not be withheld unless there are definite contraindications to operation. Intravenous cholangiography is of great value to the surgeon in anticipating the position of the cystic duct remnant as well as anomalies of the extrahepatic biliary system.

Cholecystography was attempted in 17 of the 35 patients in this series—in 13 by the oral method. In 7 cases there was no concentration of the medium, in 3 a cystic duct was visualized, and in 3 a gallbladder remnant was seen.

Since 1953, intravenous cholangiography has been performed on 121 patients following cholecystectomy. Cystic duct remnants were demonstrated in 24 patients. Many of these had been referred from elsewhere for special examinations and therefore are not included in the present study.

Four roentgenograms; 13 drawings; 5 tables.

JAMES A. LYON, JR., M.D.
University of Pennsylvania

Annular Pancreas. Its Roentgen Diagnosis and a Report of a Case Preoperatively Diagnosed and Successfully Treated Surgically. Herbert S. Berlin and Julius Taylor. Gastroenterology **29**: 439–445, September 1955.

The authors could find records of only 5 cases of annular pancreas correctly diagnosed preoperatively (Castleton *et al.*: Am. Surgeon **19**: 38, 1953; Gillette and Lynch: Ann. Surg. **139**: 374, 1954. Abst. in Radiology **64**: 146, 1955). The following criteria have been established for the diagnosis: (1) a smooth, uniform, extrinsic pressure defect several centimeters in length in the descending duodenum just proximal to the papillary region on the right border; (2) "atrophic" appearing mucosa in the narrowed segment, with small, crowded valvulae conniventes. There may also be some secondary dilatation of the proximal duodenum and the stomach. In the differential diagnosis, one must consider ulcerative duodenal disease, neoplasm, and extrinsic pressure effects due to a mass or lymph nodes.

In the case reported, roentgenograms showed a pressure defect in the second portion of the duodenum and "atrophic" mucosa, leading to a preoperative diagnosis of annular pancreas, which was confirmed at laparotomy. A by-pass gastroenterostomy was successfully performed. This type of operation was considered preferable to "unhooking" of the pancreatic ring, which has been accompanied by a high postoperative morbidity, fistula formation, and mortality.

Three roentgenograms; 1 photograph; 2 drawings.

A. R. BENNETT, M.D.
Mt. Sinai Hospital, Cleveland

Gas in the Portal Veins of the Liver in Infants. A Roentgenographic Demonstration with Postmortem Anatomical Correlation. John N. Wolfe and William A. Evans. Am. J. Roentgenol. **74**: 486–489, September 1955.

A report is made of 6 cases, in infants, in which the presence of gas in the portal veins of the liver was confirmed by suitable postmortem studies. In 4 of the group gas patterns were demonstrated overlying the liver on films made before death. Generally transverse linear and band-like areas of rarefaction were seen crossing the substance of the liver and tending to gather at the liver hilus. Bronchovascular markings at the base of the lung may produce somewhat similar patterns, but their disposition and direction should prevent confusion. These gas markings are compatible with air or gas in the biliary radicles, but carefully performed postmortem examinations revealed no air in the common bile duct nor in the gallbladder and no gas-forming organisms could be isolated from the bile ducts. Additional microscopic studies of the biliary system showed no evidence of inflammation, so that air in the biliary radicles was considered excluded. Small air bubbles within the portal vein and its main branches were demonstrable at autopsy.

The 6 cases are reported in considerable detail. All of the infants presented marked gaseous distention of the bowel, sometimes associated with obstruction of

the intestine. In all, postmortem blood cultures were positive for *E. coli*. The authors theorize that gas under increased tension in the bowel is forced into the mesenteric veins and collects in the portal system of the liver. Three of the 6 cases showed pneumatosis of the bowel.

Four roentgenograms. JAMES W. BARBER, M.D.
Cheyenne, Wyo.

THE DIAPHRAGM

Diaphragmatic Relaxation of Cervical Origin. M. Ramseyer. Radiol. clin. **24:** 272–275, September 1955. (In French)

Diaphragmatic relaxation, or eventration, manifests itself by elevation of a part or the whole of a hemidiaphragm; the mobility is either diminished or abolished on inspiration, or is paradoxical. The condition is said to be 15 times more frequent on the left side, probably due to the fact that relaxation on the right is less easily visualized because the liver is not so readily displaced as the viscera in the left hypochondrium. Histologically there is a more or less pronounced muscular atrophy. While some cases are congenital, most are acquired. Rarely the cause is within the diaphragm itself, such as myositis. Lesions in the phrenic nerve are most often responsible.

The author reports the case of a 42-year-old man, who was struck upon the left shoulder by a block of asphalt weighing about 100 kg. He returned to work at the end of two months, still suffering from pain in the arm. Some two years later the pain at times became intolerable, radiating from the back of the neck into the arm. While this severe pain was episodic, heaviness in the shoulder and the left arm was constant. Muscle strength was nearly normal except at the time of the acute crises. No muscular atrophy, circulatory difficulties, or disturbances in sensation were present.

As opposed to the normal cervical roentgenograms at the time of the accident, those made two years later showed a scoliosis, with concavity to the right, and a suppression of the normal cervical lordosis, replaced by a slight kyphosis. The left intervertebral foramen between C-3 and C-4 was narrowed by osteophytic proliferations from the posterior and inferior angle of C-3 and by thickening of the superior portion of the pedicle of C-4.

Examination of the chest at the time of the injury showed a normal level of the left diaphragm, but several years later it was found to be three finger breadths above the right, with diminished respiratory excursion. Two plaques of atelectasis in the left lung base were also noted.

Four roentgenograms.

CHRISTIAN V. CIMMINO, M.D.
Fredericksburg, Va.

The "Diaphragm-Liver Hump" Associated with Multiple Defects. W. Swoboda and H. G. Wolf. Radiol. clin. **24:** 218–224, July 1955. (In German)

The "diaphragm-liver hump" is a rather frequent finding in children, usually without significance. It is due to underdevelopment of the muscular fibers in the involved segment of the diaphragm, usually on the right side anteriorly.

Three cases are presented, with associated congenital deformities. The first and second children had a whole series of bony deformities, involving the ribs, sella turcica, and hard palate, Klippel-Feil's syndrome, and Sprengel's deformity. In the third there was strikingly delicate rib structure, but no gross malformation. This child died on the third day of life from pneumonia, an evidence of "mesenchymal weakness." Autopsy was not obtained.

Other cases have been reported with associated defects in the spleen, kidney, and heart. The authors have seen the "hump" in a case of Fallot's tetrad.

Ten roentgenograms.

CHRISTIAN V. CIMMINO, M.D.
Fredericksburg, Va.

THE MUSCULOSKELETAL SYSTEM

Tumors of Periosteal Origin. Louis Lichtenstein. Cancer **8:** 1060–1069, September–October, 1955.

This paper offers a comprehensive discussion of tumors of periosteal origin. These neoplasms constitute a unique group and their clinical behavior cannot be inferred by drawing analogies with tumors arising elsewhere.

Benign Tumors: Benign tumors arising from the periosteum include fibroma, neurofibroma, lipoma, and chondroma:

The *periosteal fibroma* occurs as a benign surface growth usually in the distal femur in an adolescent or young adult male. Radiographically, a superficial cortical defect results. Morphologically, a benign fibroblastic growth is seen. Treatment is by simple excision and perhaps curettement of the underlying sclerotized cortex.

Neurofibromas may develop within the periosteum as a manifestation of von Recklinghausen's disease. Roentgenologically, a blister-like lesion is seen eroding the cortex and elevating the periosteum. There may be diffuse thickening of the periosteum, as the disease becomes more extensive, and irregularity of the adjacent cortical bone. Malignant change is not uncommon, and is manifested by erosion and invasion of contiguous bone.

Periosteal chondromas may arise from the smaller bones of the hands and feet or from the shafts of the larger limb bones. The chondroma grows slowly, developing within the periosteal connective tissue, and erodes contiguous cortical bone, producing sclerosis. These features aid in differentiation from osteochondroma ("exostosis") or solitary enchondroma. Morphologically, the tumor is composed of hyaline cartilage. It may appear in children or adults and cause local pain and gradual swelling. Conservative surgical extirpation with curettement of the sclerotic cortex and block excision give uniformly satisfactory results.

Lipomas may develop as slowly growing circumscribed tumors of lobulated fat in the soft parts of an extremity in contact with the periosteum and may attain appreciable size. A well demarcated, round radiolucent mass abutting on a contiguous bone is seen radiographically. It usually is present adjacent to a long limb bone.

Malignant Tumors: Of the malignant tumors originating in the periosteum, the fibrosarcoma, chondrosarcoma, and osteogenic sarcoma are discussed:

Fibrosarcoma produces a slowly enlarging mass which, when it has attained appreciable size, erodes the underlying cortex without invading the medullary cavity. The tumor is seen more frequently in sites other than the large limb bones and is of low-grade

malignancy, with a disposition to local recurrence after incomplete surgical extirpation. The recommended treatment is conservative removal if adequate clearance can be effected.

Chondrosarcomas of periosteal origin are rare. The author has observed only a single case, in which the roentgenologic features were similar to those of periosteal chondroma. The tumor was apparently of low-grade malignancy. Wide block excision was carried out.

Periosteal *osteogenic sarcomas* arise from progressive active proliferation of bone-forming periosteal connective tissue and appear on the surface of large limb bones, particularly the femur. They have a more favorable prognosis than intramedullary osteogenic sarcomas. A second type of osteogenic sarcoma arising in this area is the parosteal or juxtacortical osseous metaplasia that results in a subtle slowly progressive malignant change. This may be analogous to the comparatively rare sarcoma that develops from myositis ossificans. These tumors produce bulky lesions of parosteal ossification and should be treated with prompt amputation *providing* there is pathologic evidence of malignant change. Although there is a strong tendency for recurrence following local surgical extirpation, it is thought that these lesions are not in every case potentially malignant and that, if they were treated categorically by amputation, limbs might be needlessly sacrificed. Contrary to the juxtacortical osteogenic sarcoma, the osteogenic sarcoma arising primarily in the periosteum is initially malignant. This tumor is so rare that no informative precedents have been set to indicate the clinical course to be expected or the choice between block resection and amputation as a therapeutic approach.

Seven roentgenograms; 6 photomicrographs; 2 photographs.

JOHN W. WILSON, M.D.
University of Texas, Dallas

Osteoporosis—Commonest of All Diseases. W. P. U. Jackson. South African M. J. **29:** 885–890, Sept. 17, 1955.

Osteoporosis has been shown to arise not primarily as a disorder of calcium or phosphorus metabolism, but rather as a deficiency in the continued formation of the protein matrix of bone by osteoblasts, upon which bone salt is deposited. This is in contrast to osteomalacia, where the matrix, or osteoid, is present but the minerals are lacking. The author feels that, while his designation of osteoporosis as the commonest disease entity may be questioned, it is ubiquitous and may result from many causes. He lists the following:

I. Defect in osteoblasts
   - A. Loss of stress-and-strain from tissue (immobilization due to restraints and in bedridden patients; ? pulmonary emphysema)
   - B. Lack of estrogen (artificial or natural menopause, ovarian agenesis)
   - C. Congenital osteoblastic deficiency, as in osteogenesis imperfecta
   - D. Lack of vitamin C.

II. Defect in the protein matrix
   - A. Insufficient supply of protein (protein malnutrition, ? jejuno-ileal insufficiency, ? hyperthyroidism, and ? diabetes mellitus)
   - B. Anti-anabolic effect: (lack of androgen (eunuchoidism, senility and ? paraplegia) or excess of glucosteroids (Cushing's syndrome, ACTH and/or (hydro)cortisone therapy, and, ? alarm reaction)

III. Unknown causes, including those responsible for the porosis seen in acromegaly, idiopathically in young people, and in ? biliary cirrhosis and ? some cases of rheumatoid disease

IV. Such oddities as Werner's syndrome, metaphyseal dysplasia, and ? hypophosphatasia.

Radiologically it is seen that the brunt of decalcification is borne by the spine and the bones of the trunk, the pelvis, the ribs, the sternum, and the upper portions of the femora. The vertebral bodies become radiolucent, the trabeculae may be prominent but are not coarsened, and the outlines appear pencilled in. The disks expand into the adjacent bodies and the vertebrae become variably biconcave, with partial fractures of the vertebral plates or with more or less severe compression fractures. The whole spine becomes "squashed," leading to kyphosis and loss of height.

Fractures may also occur in other bones, particularly in the neck of the femur. Indeed, the author views most fractures of the femoral neck as pathological, with an underlying osteoporosis. Further immobilization of such fractures leads to intensification of the underlying disease and is to be condemned except in the face of necessity due to pain.

The skull, trunk, pelvis, ribs, sternum, long bones, feet, and hands are involved later and less dramatically.

Ten roentgenograms; 2 drawings; 1 table.

SAUL SCHEFF, M.D.
Boston, Mass.

Weber-Christian Disease with Bone Involvement. C. J. DeLor and R. W. Martz. Ann. Int. Med. **43:** 591–598, September 1955.

The author presents a general review of Weber-Christian disease (chronic relapsing febrile nodular nonsuppurative panniculitis) and reports a case with bone involvement. The essential feature of the disease is recurrent crops of subcutaneous nodules, most commonly on the extremities and trunk. Histologically these show three phases. In the first there is an inflammatory reaction in the adipose tissue, with edema, congestion, and infiltration of polymorphonuclear leukocytes, lymphocytes, and macrophages. Necrosis of the fat cells and phagocytosis of the fat by macrophages follow. In the final phase, there is atrophy of the fat, with connective-tissue replacement. Destructive bone changes have not previously been reported.

The authors' patient was a 42-year-old man with multiple nodules throughout the subcutaneous tissues of both lower extremities. The terminal interphalangeal joint of the right index finger and the proximal joint of the left thumb were swollen and tender. The fourth right toe was swollen, red, and exquisitely painful to touch. The great toes were similarly but less extensively affected. Roentgen examination of the hands revealed subcutaneous edema with cystic, destructive changes in the shaft and cortex of the right index finger and left thumb. Similar destructive processes involved the metatarsal phalangeal joint of the fourth right toe. Possible diagnoses considered by the radiologist were gout, sarcoidosis, and rheumatoid arthritis. A punch biopsy of one of the subcutaneous nodules on the left leg was performed and the pathologic report was lipogranuloma compatible with Weber-Christian disease.

With the consent of the patient, the inflamed right

toe was amputated just proximal to the metatarsal head. There was fibrosis of the adjacent tissue associated with an infiltration by lymphocytes, macrophages, and multinucleated giant cells, all of which were interpreted by the pathologist as consistent with a diagnosis of Weber-Christian disease.

Two roentgenograms; 2 photomicrographs; 1 photograph.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

A Contribution to "Osseous" Arthropathia Deformans. H. Platzgummer and A. Ravelli. Fortschr. a. d. Geb. d. Röntgenstrahlen **83:** 378–382, September 1955. (In German)

The authors consider the terms arthropathia deformans and arthritis deformans as synonyms. They open the old and still controversial question as to whether arthritis deformans takes its origin in the cartilage or in the subchondral bone. They believe that, while the majority of cases are of cartilaginous origin, there is a smaller group which may be attributed to osseous changes. In their opinion, a small subchondral aseptic necrosis may lead to a collapse of the osseous framework which supports the cartilage, thus leading to a cartilaginous defect and to a deformity which later on sets the osteoarthritic changes in motion.

The paper includes the case history and roentgenograms of a twenty-five-year-old man, who had pain in the left knee for nine months. The films show a slight subchondral bone necrosis in the medial condyle.

[To the abstracter, the roentgen appearance is strongly suggestive of osteochondritis dissecans. The authors do not seem to make a clear distinction between arthritis deformans and the various types of juvenile aseptic necrosis.—W.A.M.]

Four roentgenograms.

WILLIAM A. MARSHALL, M.D.
Chicago, Ill.

Vertebra Plana Osteonecrotica (Calvé's Disease): An Unusual Location. Ed. and P.-J. Rosselet. Radiol. clin. **24:** 278–281, September 1955. (In French)

The authors report the case of an 8-year-old child who complained of pain in the cervicodorsal region. Three months after the onset of the symptoms, radiographic examination of the spine showed the first dorsal vertebral body to be reduced to a thin bony plate with its anterior border extending slightly beyond the normal vertebral alignment. The intervertebral disks above and below the plate were intact, a point emphasized by Calvé as characteristic of the disease which bears his name. Examination six years later showed partial reconstruction of the involved vertebral body, which was then about half its normal height. The patient was without symptoms.

It has been thought that vertebra plana is an aseptic necrosis, the vertebral body gradually diminishing in height under the effects of multiple microtraumatism. The age of the patients and the usual localization at the lower dorsal or first lumbar vertebra all speak in favor of this hypothesis. Some cases, however, show involvement of several vertebrae, associated with lesions in other bones, especially the skull. Several of these cases have been proved to be examples of eosinophilic granuloma. In the present case no other lesions were visible radiologically nor were there clinical signs suggesting involvement of other parts of the skeleton.

The author feels, therefore, that vertebra plana is not a definite disease entity, but is evidence either of an aseptic necrosis or of a systemic affection such as eosinophilic granuloma. He pleads for a complete radiologic examination in patients with the latter condition, pointing out that, while lesions in this disease are generally solitary, they may be multiple. Only thus will it perhaps be possible better to define the relationship between vertebra plana and eosinophilic granuloma.

Four roentgenograms.

CHRISTIAN V. CIMMINO, M.D.
Fredericksburg, Va.

Block Synostosis of Cervical Vertebral Bodies Following Osteochondrosis. K. F. Shlegel. Fortschr. a. d. Geb. d. Röntgenstrahlen **83:** 373–377, September 1955. (In German)

"Block" synostosis of vertebral bodies in the cervical spine may be caused by various etiological factors. It may be congenital, in which case it often involves not only the vertebral bodies but also the laminae and the various processes; it may be the end-result of severe infectious conditions, chiefly tuberculosis; or it may be the outcome of severe trauma, notably a fracture of the bodies with crushing and laceration of the intervertebral disk. Not much has been published about the relationship of vertebral block synostosis and osteochondrosis. It is generally assumed that, while osteochondrosis may produce a bridge type of union between two or more vertebral bodies by means of lipping along their edges, it seldom leads to a block type of union with disappearance of the intervertebral disk.

The author believes that osteochondrosis may produce block synostosis and confirms it by showing the x-ray films of one of his own cases. A 56-year-old farmer fell from a carriage, landing on his head and back. Six weeks later an x-ray film of the cervical spine revealed marked osteochondrosis of the fourth, fifth, sixth, and seventh cervical vertebrae, but no involvement of the disk spaces, aside from possible slight narrowing between C-5 and C-6. Two years later another film showed practically the same findings, which would suggest that the subsequently demonstrated fusion was not the direct result of the injury. After five more years a complete block synostosis between C-5 and C-6 was apparent on routine films as well as by tomographic examination. Vertical bone trabeculae traversing both vertebrae were demonstrated. A complete physical examination failed to show any other disease. The only symptom was pain in the arms due to nerve root involvement.

Five roentgenograms.

WILLIAM A. MARSHALL, M.D.
Chicago, Ill.

Tarsal Synostoses in Painful Flatfoot (Valgus). E. de Marchi, R. Gambier, and L. Vespignani. J. de radiol. et d'électrol. **36:** 665–674, 1955.

In a collected series of 128 cases of painful flatfoot there were 39 calcaneo-scaphoid synostoses, 37 calcaneo-astragalar synostoses, one scapho-astragalar synostosis, and one scapho-cuboid synostosis. In 50 cases no synostosis was found.

While the presence of synostosis may be suspected from routine views of the foot, special views depict the condition more accurately. An oblique dorsoplantar projection may be obtained by two methods. In the method of Chaumet-Ferry the plantar surface is held against the film and the tube is placed laterally, inclined

45 degrees in the latero-internal direction. Slomann (J. Orthop. Surg. **3:** 586, 1921) recommends placing the foot in 45 degrees internal rotation, with the x-ray beam directed perpendicular to the film. Roentgenograms obtained by these projections show, in a normal foot, a clear space between the distal superior part of the calcaneus, the distal inferior part of the astragalus, and the inferior part of the scaphoid.

The posterior oblique position, proposed by Harris and Beath (J. Bone & Joint Surg. **30-B:** 624, 1948. Abst. in Radiology **53:** 613, 1949) is quite analogous to the so-called vertical view of the calcaneus. The subject is standing, with the knees flexed and the foot flat against the film; the tube is placed behind the foot and the beam is directed antero-inferiorly at an angle of 45 degrees with the vertical, toward the astragalocalcaneal joint. The leg must be flexed on the foot to disengage the inferior surface of the astragalus from the shadows of the tibia and fibula. On the roentgenogram the longer lateral tract between the bones corresponds to the posterolateral part of the articulation. The shorter internal tract corresponds to the articulation between the sustentaculum tali and the astragalus.

When the posterior oblique projection fails to supply adequate detail in suspected calcaneo-scaphoid synostosis, stratigraphy (planigraphy, tomography) may furnish more precise detail.

Forty-one roentgenograms; 1 photomicrograph; 1 table.

CHARLES M. NICE, JR., M.D.
University of Minnesota

GYNECOLOGY AND OBSTETRICS

Gynecography Simplified. Herman A. Strauss and Melvin R. Cohen. Am. J. Obst. & Gynec. **70:** 572–580, September 1955.

A simplified method of gynecography using standard x-ray equipment is presented. Pneumoperitoneum is established with 1,000 c.c. of carbon dioxide by the transabdominal or transuterine route (as in the Rubin test); hysterosalpingography is then carried out in the usual manner. Radiographs are made of the pelvic area in the prone position, with the head of the table lowered 15° and buttocks elevated by 4-inch pads.

In numerous instances, otherwise obscure pelvic abnormalities can be demonstrated. Pneumoperitoneum with or without hysterosalpingography is safe and may be used when iodized oil is contraindicated.

Five roentgenograms; 1 photograph; 3 drawings.

R. L. EGAN, M.D.
University of Texas, Houston

THE GENITOURINARY SYSTEM

Improved Urography in Infants and Small Children with Simultaneous Filling of the Stomach with Fluids and Air. W. Kosenow. Fortschr. a. d. Geb. d. Röntgenstrahlen **83:** 395–401, September 1955. (In German)

Intravenous pyelography in infants and small children ordinarily does not yield very clear visualization of the kidneys, the renal pelves, the calyces, and the upper ureters, since these structures are obscured by superimposed shadows of small intestinal loops partially filled with gas. The technic that the author employs is as follows:

The children do not receive anything by mouth on the day of the examination until they are brought to the x-ray department. Then, either shortly before or shortly after the injection of the medium (Urografin 76 per cent), 100 to 250 c.c. of fluid (tea, fruit juices, or a milk mixture) are administered orally. With this the children ordinarily swallow so much air that a mixture of fluid and air accumulates within the stomach. Apparently the fluid prevents the air from entering the small intestine and, as the stomach is large and pushes the small intestinal loops downward, a film taken four minutes after the injection plainly shows the kidneys and the upper collecting system without any disturbing superimposed shadows, as if framed within the gastric outline. The homogeneous layer of fluid in the stomach does not interfere with proper visualization. Additional films are taken eight, twenty, and thirty minutes later. Sometimes small amounts of fluid have to be given before the last two exposures.

The quality of the films obtained by this procedure is such that they are comparable to retrograde pyelograms. The lower ureters, however, are usually not well visualized because of the superimposed small intestinal shadows.

Eight roentgenograms.

WILLIAM A. MARSHALL, M.D.
Chicago, Ill.

Bilateral, Symmetrical, Peri-ureteric Fibrosis. F. P. Raper. Proc. Roy. Soc. Med. **48:** 736–740, September 1955.

This is a presentation of 3 cases of what appears to be a rather obscure disease entity. In each instance the final operative and pathologic studies showed extensive bilateral peri-ureteric fibrosis involving particularly the distal third of the ureters. Six similar cases of bilateral ureteral obstruction and 2 of unilateral obstruction, apparently of the same nature, were found in the literature.

Although this disease is thought to be inflammatory, there are certain unusual features about it. First, the only recorded case in which a primary infective focus is suggested was in a patient who had ulcerative colitis for nine years before occurrence of the ureteric obstruction. Second, pyrexia does not seem to be a feature of this disease. In one of the reported cases, even though a biopsy showed the presence of small abscesses among chronic inflammatory tissue, there was no fever until ten days after operation. Third, in none of the cases is there any mention of enlarged lymph nodes. Finally, the appearance of the fibrous tissue engulfing and infiltrating the ureters indicates it to be of a highly active type, unlike that which occurs during the healing of acute or chronic bacterial infections.

It is suggested that the disease may be primarily arterial or periarterial, a view which is supported by a fourth case presenting as an arterial block.

Three roentgenograms; 1 photomicrograph.

JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Secondary Reactions from Contrast Media and the Allergy Concept. Carl Sandström. Acta radiol. **44:** 233–242, September 1955.

The general assumption that the reactions which are occasionally observed after injections of urographic contrast media are allergic in nature is open to question. This article includes a historical review of the subject, and presents evidence against and in support of the allergy theory.

In 1,557 patients, repeat urographic examinations were performed from two to ten times. No sensitization was observed in any patient. Patients with secondary reactions during an earlier examination, in one or more repeat examinations, had slighter symptoms or none at all. Preliminary skin or mucous membrane tests for possible allergic hypersensitivity were found to be unreliable. Secondary reactions were no more common in patients with a history of allergy than in others with negative histories. In addition, no evidence could be elicited that a contrast medium acts as an antigen or produces antibodies.

On the other hand, secondary reactions, both local and general, do resemble allergic reactions clinically. Also, they are affected by drugs such as adrenalin and calcium.

The author arrives at the conclusion that the reaction is actually a toxic response to contrast substance but is generally mistaken for allergy because of the similarity of the clinical pictures.

One table. DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

THE ADRENALS

An Adrenal Tumor, Clinically Doubtful; Diagnosis Established by Extraperitoneal Pneumography. H. Lisser. J. Clin. Endocrinol. & Metab. **15**: 1144–1149, September 1955.

This excellent case report stresses the importance of the introduction of oxygen presacrally for demonstration of an adrenal tumor. Except for this procedure, the tumor would almost certainly have gone undetected.

Although the referring physician suspected Cushing's disease, the history, physical examination, and laboratory tests failed to furnish any convincing evidence of that condition. Urograms showed only slight displacement of the left kidney to the left and minimal rotation anteriorly, but the upper calyx was not flattened or depressed downward. Under a pressure of 30 cm. of water, 1,300 c.c. of oxygen was administered presacrally and tomograms were obtained, revealing a left adrenal tumor measuring 4 × 7 cm. The tumor was removed and the somewhat vague symptoms were relieved.

One roentgenogram; 8 photographs.
JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

MISCELLANEOUS

Roentgenological Observations in the Acrosclerotic Form of Generalized Scleroderma. A. Leszler. Fortschr. a. d. Geb. d. Röntgenstrahlen **83**: 353–365, September 1955. (In German)

It is now generally recognized that scleroderma is not merely a skin condition but a systemic disease of the vessels and of the connective tissues (collagen disease). Radiological changes can be demonstrated in the soft tissues, the skeleton, the lungs, the heart, and the gastrointestinal tract.

In the soft tissues, there may be irregular calcific deposits occurring most frequently in the vicinity of the joints. Sometimes these break through the skin, forming a fistula through which a milky secretion exudes.

The bony changes are mostly those of osteoporosis and of osteolysis. The osteoporosis occurs mainly in the hands and feet and may be due to inactivity, since it is more often found in patients whose joints have become stiff and limbs more or less useless. Osteolysis is seen predominantly at the ends of the terminal phalanges of the fingers and toes. It may lead to severe mutilation of the hands.

In the gastrointestinal tract, the most characteristic changes are found in the esophagus. Due to submucosal sclerosis the folds of the mucosa are lost and it becomes smooth and atrophic. Peristaltic activity is markedly impaired, and the esophagus becomes rigid. A liquid barium meal will still pass into the stomach quite easily, but a thick barium paste may be retained for hours. A partial obstruction of the cardia may result. Ulceration may develop in the lower esophagus and the ensuing scar formation may pull up the stomach, producing a hiatus hernia. No changes are noted in the stomach, but the small intestine again shows a lack of mucous folds, and there may be narrowing of some sections, preceded by compensatory dilatation. The changes in the colon resemble those of a chronic colitis.

In the lungs, only the lower portions are involved. A fibrosis develops, often producing peribronchial or perivascular scars and sometimes net-like indurations. Bronchiectasis frequently occurs and may lead to cystic cavitation.

Changes in the heart are seldom observed, but cardiac enlargement has been described. The electrocardiogram shows changes characteristic of myocardial disease.

The author has observed 22 proved cases of scleroderma, 8 of which he presents in detail. Soft-tissue calcifications were found in 13.6 per cent of his series, osteolysis of the hands in 72.7 per cent, gastrointestinal changes in 50 per cent, and pulmonary changes in 36. 3 per cent.

Of special interest are the author's investigations of the hypophysis. Many of his patients had a small flattened sella turcica as seen on the x-ray films. In some the sella was enlarged, but in all cases there was diminished function of the hypophysis as demonstrated by a flattened blood sugar curve and other clinical observations. On this basis, it is concluded that the sella turcica and the basal ganglia of the brain probably play a role in the etiology of scleroderma.

Fifteen roentgenograms.
WILLIAM A. MARSHALL, M.D.
Chicago, Ill.

TECHNIC

Technic, Indications, and Value of Retropneumoperitoneum in the Examination of the Abdominal Space. J. Franzen. Röntgen-Blätter **8**: 258–274, September 1955. (In German)

Because of intercommunication between the subserous spaces of the pelvis (perirectal, perivesical), abdomen (perirenal), chest (periaortic), and neck (subfascial), gas introduced at any of these levels will diffuse throughout the entire system under physiologic conditions. On this anatomical fact is based the negative roentgenologic contrast procedure, introduced in Spain by Ruiz-Rivas (1948) under the name "generalized subserous emphysema" (see Am. J. Roentgenol. **64**: 723, 1950. Abst. in Radiology **57**: 618, 1951), later called "retropneumoperitoneum" in France and "extraperitoneal pneumo-abdomen" in Italy.

The procedure is indicated for the demonstration of tumors (in the broadest sense of the word) of the kidneys, suprarenals, pancreas, retroperitoneal lymph nodes, retroperitoneal nerve structures, subdiaphragmatic esophagus and/or cardia, ureter, bladder, rectum, ovaries, etc.; for developmental anomalies of the kidney (horseshoe, polycystic, agenesis, congenital hydronephrosis); and, generally speaking, in any case involving a change in size or shape of an abdominal organ. It should not be attempted in the presence of severe cardiac decompensation or any condition which would contraindicate a local surgical procedure, as proctitis.

Technic: After purgation and forty-eight hours of low-residue, non-flatulent diet, the patient is placed in left lateral decubitus, his flexed knees, supported by sandbags and pillows, being in contact with the abdomen. Under local procain anesthesia, a short-beveled needle with lateral opening is introduced through the anococcygeal raphe, the tip pointed toward the coccyx. Frequent aspiration with the attached syringe is indicated to avoid entering vessels even in this avascular area. Following passage through the anococcygeal ligament, the needle is advanced another 1 to 3 cm. If, at this point, a few cubic centimeters of air, injected with the syringe, encounter no resistance, 500 to 800 c.c. of gas are introduced; a similar amount is injected in right lateral decubitus (some authors prefer the knee-chest position). The maximum, determined by roentgenoscopic control, is 1,000 to 2,000 c.c. in fifteen to twenty minutes. Oxygen, absorbed in twenty-four to forty-eight hours, is preferable to air or CO_2. In the newborn, the total amount introduced should not exceed 200 c.c., in small children 600 c.c. After examination, the patient is kept in the horizontal position for about twenty-four hours, to avoid the occurrence of pneumomediastinum (with consequent dysphagia, precordial pain, anxiety, etc.) and cervical subcutaneous emphysema.

Roentgenography: A base line is established prior to examination, by exposing an appropriate number of abdominal views. After the insufflation is completed, a lateral roentgenogram is first taken (to avoid superimposition it should be slightly oblique, to the left or right, dependent upon the organ investigated), to which are added frontal projections with the patient in decubitus, upright (antero-posterior) and, if necessary, even in the Trendelenburg or lithotomy position. Body-section roentgenography of the posterior (pararenal) planes is recommended under all circumstances. Concomitant positive (in fact, double) contrast procedures, such as pyelography, aortography, barium enema and meal studies, are performed as required in the individual case.

Interpretation: Incomplete filling may be due to adhesions or acute processes (paranephritic or subphrenic abscess). Extensive intrapelvic adhesions can prevent the passage of gas altogether. In most instances, however, the kidneys, liver, and spleen are well delineated. At this stage, tube insufflation of the stomach and duodenum may at times permit visualization of the pancreas. The suprarenal has a "candle-flame" shape, which is preserved even in hyperplasia of the entire gland; isolated hyperplasia of the cortical part, or small adenomas, may not be demonstrable; larger tumors are identified by changes in contour or as radiolucent areas. Horseshoe kidney and retroperitoneal tumors give characteristic appearances.

Complications: Rectal perforation heals spontaneously, and the attempt to perform retropneumoperitoneum may be repeated after forty-eight hours. Gas embolism, although possible, is exceedingly rare. By comparison with perirenal insufflation, retropneumoperitoneum is considered practically an innocuous procedure.

Nine roentgenograms. E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

Diagnostic Pneumoperitoneum. S. C. Truelove and K. Lumsden. Brit. M. J. **2**: 585–588, Sept. 3, 1955.

Pneumoperitoneum in patients with or without ascites can give valuable information about the size, position and outline of the liver and spleen. The procedure is easy to perform and the risk is slight. Films should be made with the patient prone after injection of 1,000 to 1,500 c.c. of air into the peritoneal cavity at the lateral border of the left rectus abdominis muscle. In patients with ascites who are subjected to paracentesis, the air can be introduced through the cannula used for draining of the ascitic fluid.

Six examples are illustrated.

Seven roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

The Diagnostic Use of Artificial Pneumoperitoneum. Harold Guyon Trimble and William B. Leftwich. Dis. of Chest **28**: 282–289, September 1955.

It is pointed out that many surgeons, radiologists, and general practitioners have remained hesitant to utilize pneumoperitoneum as a part of their diagnostic armamentarium, due probably to their unfamiliarity with the technic and to the overemphasis in the medical literature on the dangers, contraindications, and complications. In the authors' opinion, the procedure is relatively benign.

Artificial pneumoperitoneum may be a diagnostic aid in a variety of clinical situations such as: (1) suspected subdiaphragmatic abscess; (2) lesions in the cardia of the stomach, when pneumoperitoneum is combined with a barium meal; (3) detection of ascites when the amount of fluid is small; (4) study of pelvic organs of adult females; (5) study of sex-endocrine disorders; (6) study of patients whose chest x-ray films show densities in the lower thorax in contiguity to the diaphragm.

Each of the conditions mentioned is discussed in some detail, with references to the literature.

Eight roentgenograms. JULIAN S. LEWIS, M.D.
Cleveland City Hospital

Simultaneous Stereoangiography. I. Fernström and K. Lindblom. Acta radiol. **44**: 230–232, September 1955.

Stereoscopic radiography has never worked out well for angiographic examinations, because of the change in phase of vascular filling taking place during the making of exposures. The use of a rapid cassette changer and two tubes placed close together, with rapid alternate exposures would overcome this objection. However, the casings on ordinary tube heads are so thick that it has not been possible to approximate the tubes sufficiently to form a good stereo angle.

If one tube is placed 10 cm. above the other, and then brought as close to it as possible, the tube apertures may be arranged to give the desired angle between the x-ray beams. The slight difference in degree of dis-

tortion from the two tubes is negligible, and good stereoscopic pairs may be thus obtained.

Two roentgenograms; 1 photograph.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Portal Pressure and Medication by Percutaneous Splenic Route. An Experimental Study. Frederic W. Taylor and David G. Gastineau. Am. J. Surg. **90**: 392–396, September 1955.

With a view to avoiding the necessity of laparotomy in determinations of portal pressure and administration of drugs into the portal system in experimental animals, the authors investigated the possibility of employing a percutaneous splenic route. Six dogs were used in this study, the spleen being first transfixed into a pocket beneath the skin, with the splenic pedicle passing through a defect in the abdominal wall which did not cause constriction.

While the paper is concerned chiefly with the pressure readings and the effect on the liver of the introduction of silicon dioxide by the percutaneous route, attempts to visualize the portal system by percutanous injection of 10 c.c. of 75 per cent Neo-Iopax or 70 per cent Diodrast are also reported. Of 19 attempts, 18 were successful. The best studies were obtained immediately following the injection.

Two roentgenograms; 4 photographs.

WILLIAM SNOW, M.D.
Shreveport, La.

RADIOTHERAPY

Grenz-Ray Therapy and Its Indications. R. M. Bohnstedt. Strahlentherapie **98**: 133–141, September 1955. (In German)

In 1924, Bucky published an article on purely superficial therapy with ultrasoft roentgen rays, using the misnomer *Grenzstrahlen* (borderline rays) to designate a wave length of 1 to 2°Å. Biologically and physically, radiation at this level is part of the roentgen spectrum, and its behavior and effects are in no way unexpected. After being relatively neglected for two decades, grenz-ray therapy is again receiving attention because of its advantages in dermatologic conditions.

Bucky expressed the belief that grenz rays have different biologic effects, but this has not been confirmed experimentally; it is merely a matter of the amount of energy reaching the deeper skin layers. With 60 kv and 1.5 mm. Al filtration, the h.v.l. for tissue is 17 mm.; with 30 kv and 0.3 mm. Al, the tissue h.v.l. is 3.5 mm., while for unfiltered rays it is 0.6 mm. This explains why grenz rays do not cause epilation, since the hair follicles, (3.3 mm. below the surface) receive only about 7 per cent of the amount of radiation reaching the skin.

There is no definite erythema dose for grenz rays; an erythema may result after a few hours, or after several days, with 200 r, while for another patient 2,000 r may be necessary. In high doses the epidermis can be permanently damaged, with eventual acanthosis, hyperkeratosis, parakeratosis, or even telangiectases and pathologic pigment formation, but severe skin atrophy and ulcer formation have never been described.

When the eyelids are being treated, a lead shield should be placed over the bulb. At this site overcautiousness is advisable, but otherwise secondary radiation is so soft that protective measures for either patient or operator are superfluous. Fractionation of dosage is indicated, the average being 100 to 500 r daily, at ten-day intervals, to a total of 1,500 r in thirty days. Under special circumstances the daily dose may be increased to 1,000 r, for a maximum total of 10,000 r within one year.

The indications for grenz-ray therapy, which initially were considered to include the entire realm of dermatology, have been gradually restricted so as to exclude all subepidermal processes. Good results may be expected in (1) the *eczema group*, including resolving dermatitis, contact and food allergies, secondary eczematization in epidermophytosis (the epidermophytosis itself and other mycoses should be treated with harder radiation), the eczematous stage of mycosis fungoides, neurodermatitis disseminata, and circumscribed anal and genital eczema; (2) *psoriasis;* (3) *lichen ruber planus*, but not lichen ruber verrucosus, which requires a shorter wave length; (4) *verruca plana;* (5) *naevus flammeus.*

Whenever the physical conditions are such that grenz rays appear applicable, they should be used in preference to harder rays, because of the lesser hazards involved.

One graph; 2 tables.

E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

Low-Voltage, Short-Distance Roentgen Therapy. Jesús M. Farías Rodríguez. Rev. mex. de radiol. **9**: 252–269, September–October 1955. (In Spanish)

The author considers low-voltage irradiation the method of choice for superficial lesions. Here he gives a detailed description of two different types of machines: the Philips (45 kv) for contact therapy and cavities, and the Siemens "Monopan" (60 kv). With the Philips apparatus the output is approximately 8,000 r per minute with a target skin distance of 2.0 cm. The penetration is somewhat limited, ranging between 0.4 and 1.7 cm., depending on the factors employed. With the Siemens "Monopan" an approximate output of 1,600 r per minute is obtained at 1.5 cm., and a penetration of 0.6 cm. without filter; with a filter giving 3.3 mm. Al h.v.l., the penetration may reach 2.2 cm. The total dose for superficial cancer varies from 5,000 to 15,000 r, fractionated for a daily dose of 300 r to 500 r. The reactions observed, both in quantity and quality, are not different from those seen with other technics.

This type of treatment is used in well circumscribed neoplasms which are accessible and have small volume and depth, especially lesions located near the eye, since it facilitates protection of the more vulnerable tissues of this region. The author has treated carcinoma of the skin, and of oral and vaginal mucosa, and small non-infiltrative lesions of the cervix by this method.

No statistics are included, since follow-up has been inadequate. The results, however, are considered satisfactory, and statistics of others show this technic to be more effective than the usual types of roentgen and radium therapy.

Thirty-eight figures.

FABIO SALCEDO, M.D.
St. Vincent's Hospital, N. Y.

Convergent Moving Therapy in a Horizontal Plane. Convergence in a Cone. José Noriega Limón and Mario Aguilar. Rev. mex. de radiol. **9:** 236–250, September–October 1955. (In Spanish)

"Convergent movement radiotherapy in a horizontal plane" and "convergent therapy in a cone" are the authors' designations for convergent beam therapy. With the patient in decubitus position, on a rotary table, the beam of radiation is focused on the tumor at a fixed angle, which has been chosen beforehand. As the table rotates, the beam reaches the skin of the patient, covering a circular surface area and converging at the center of the tumor. In this way, a volumetric distribution is obtained, which has the form of a cone. The authors have used two different types of rotary tables devised by themselves; one of them gives a complete turn every two minutes and the other every three minutes. To calculate the dosage, they have followed the methods described by Green (Acta radiol. **31:** 273, 1949. Abst. in Radiology **54:** 633, 1950) and especially the method of Quimby, Castro, and Soifer (Radiology **63:** 201, 1954). The factors have been: 200 and 250 kv, 50 cm. distance, h.v.l. of 1 to 1.8 mm. Cu, and fields 4 to 6 cm. in diameter.

The method is indicated in the treatment of tumors which are relatively small (2 to 6 cm. in diameter) spheroid in form, of eccentric location, and not deeper than 8 cm., such as malignant lesions of the tonsils, base of the tongue, maxillary antrum, and urinary bladder, bronchial tumors, pulmonary metastases, and primary or recurrent cervical carcinoma. The tumor dose is high and homogeneous and general and cutaneous reactions are markedly diminished.

The greatest limitation of the reported method in comparison with other methods of movement therapy, such as spiral convergent therapy and pendulum convergent therapy, is the lower depth dose. This method, is therefore, most suitable for tumors not deeper than 8 cm.; deeper tumors are treated by other methods.

The immediate results of the authors are promising, but because of the small number of patients, statistics are not given.

Twelve figures. FABIO SALCEDO, M.D.
St. Vincent's Hospital, N. Y.

Estrogen and Combined Estrogen and X-Ray Therapy. Their Effects on Advanced Malignant Salivary-Gland Tumors. George White and Gerald G. Garcelon. New England J. Med. **253:** 410–412, Sept. 8, 1955.

On the basis of the good clinical response to estrogens followed by nominal doses of x-ray therapy in patients with advanced breast carcinoma, the authors tried the same regime in 8 cases of advanced cancer arising in or around the salivary glands. They consider their results encouraging.

It appears that the daily estrogen dosage must be high (about 40 mg. of diethylstilbestrol) and the preirradiation period lengthy (three to four months) for the best effects. Interestingly enough, there appears to be regression of both the primary and metastatic disease with prolonged estrogen therapy *per se*. In recurrence of disease, the treatment may be repeated. The radiation dose ranged from 1,500 to 6,800 r, the smaller doses giving good results in patients previously treated with estrogen.

Two tables. SAUL SCHEFF, M.D.
Boston, Mass.

A 40 mc Cerium-Praseodymium-144 Beta-Ray Teletherapy Unit. J. L. Haybittle and R. V. Faben. Acta radiol. **44:** 49–56, July 1955.

The authors describe the design, construction, dosage measurements, and application of a beta-ray teletherapy unit containing 40 mc of cerium-praseodymium-144. Cerium decays with a half-life of 282 days into praseodymium-144, which in turn decays with a half-life of 17.5 minutes, emitting beta-particles of 2.97 MEV maximum energy. The source used contained initially 40 mc. of cerium-144 spread over an area 3 cm. in diameter and sealed between two silver foils. The foil facing the treatment area is 0.1 mm. thick and absorbs all the low-energy beta-particles emitted in the decay of cerium to praseodymium. Behind the source is 2 mm. of lead, which reduces the gamma-ray emission by about 60 per cent. The remainder of the shielding is duralumin. To switch the unit on and off a camera shutter mechanism is used in which the normal blades are replaced by brass 1.25 mm. thick. By means of specially designed applicators, areas up to 5 cm. in diameter may be treated at a source-skin distance of 3.5 cm. Another applicator is provided to treat an area 7 cm. in diameter at 5 cm. source-skin distance.

The depth dose curves were measured in celluloid. For areas of 3 cm. diameter and above there is a maximum at about 30 mg./cm.^{2} below the surface and a half-value-depth of about 310 mg./cm.^{2}. With the 2-cm. circle this maximum is not apparent, and the half-value-depth is reduced to 283 mg./cm.^{2}. This is due to extra beta particles scattered into the treatment area by the smaller applicator, causing an increase of surface dose relative to that at a depth. Measurements show that the absolute value of the dose-rate at 600 mg./cm.^{2} deep is the same for all fields at 3.5 cm. source-skin distance. The variation of intensity across the 3-cm. circle is ± 6 per cent about its mean value, *i.e.*, within the tolerable limits which are usually adopted in the treatment of malignant lesions by radium applicators. For non-malignant skin conditions a greater variation may be tolerated, and for this purpose larger treating areas may be used. The variations across fields of 5 and 7 cm. diameter are respectively ± 21 per cent and ± 25 per cent of their mean values. The mean dose rate at the maximum of the depth dose curve is 39 r/min. in the case of the 3-cm. diameter field at 3.5 cm. source-skin distance and 17 r/min. with the 7-cm. diameter field at 5 cm. distance. Films exposed in contact with the back of the unit and at the end of one of the applicators recorded dose-rates of 1.1 and 3.1 r/hr., respectively.

The authors also discuss the possible use of larger units, designed to treat extensive superficial lesions over field sizes up to 50 cm. in diameter. They made preliminary measurements with a 10-mc. strontium-90 source filtered by 0.1 mm. of silver and they feel that large beta-ray teletherapy units are feasible when multicurie sources of suitable fission products become available.

JULIAN O. SALIK, M.D.
Baltimore, Md.

Teleradium Therapy of Malignant Tumors with Special Regard for Dermatologic Indications. H. Kutzim. Strahlentherapie **98:** 94–103, September 1955. (In German)

In Germany, the first teleradium apparatus was put in operation in 1953 at the University Hospital in Cologne. It has 15-cm. lead walls, contains 10 gm.

of radium (in fifty 200-mg. capsules), and is installed in a remodeled air raid shelter, to the original walls of which (175 cm.) were added 65 cm. of reinforced concrete. A cone of tungsten and lead, placed in the path of the radiation, absorbs the oblique rays, and thus improves the depth dose by 20 per cent. The main filter consists of 3.0 mm. lead, while secondary radiation is stopped by an additional 0.5 mm. chromium and copper cap. The gamma radiation emitted (12 spectral bands between 2 kv and 2.5 MEV) corresponds roughly to the *Bremsstrahlung* of a 2.5-MEV betatron. At 5.5 cm. the dose rate is 1,000 r/hour, with 50 per cent at 4.5 cm. depth. After removal of the lead and tungsten cone, the rate increases to 1,310 r/hour, with 50 per cent at 3.5 cm. If the 3.0-mm. lead filter is also eliminated, the dose reaches 1,710 r/hour, with the 50 per cent isodose level 2.5 cm. below the surface.

The indications for teleradium therapy are:

(1) *Extensive skin carcinoma*, metastasizing and/or too large to be covered by contact roentgen therapy, and (2) *malignant tumors overlying bone or cartilage.* In these cases, the tumor base is first irradiated for three and a half to four days with implanted radium needles. Twelve days after removal of the needles, 1,000 to 2,000 r are given with the teleradium apparatus. Lymph node metastases receive teleradium therapy directly, up to 4,500 or 5,000 r. The nodes are excised after 1,500 r, the remainder of the dose being given fourteen days later.

(3) *Carcinoma of the penis.* Circumcision is performed following 1,000 r to the penis and to both inguinal areas. For the next eighteen days, teleradium therapy is continued over the inguinal areas, being interrupted at 3,500 to 4,000 r in the absence of clinical evidence of metastasis. Otherwise, surgery is indicated as above. The tumor area on the penis is treated finally with interstitial radiation for three to four days.

(4) *Carcinoma of the vulva.* The primary tumor is coagulated between two diathermic electrodes, layer by layer. The regional (inguinal) lymph nodes are treated in the same way as in carcinoma of the penis. There is no mention of roentgen- or radium-therapy of the primary site.

(5) *Carcinoma of the tongue.* After preliminary teleradium therapy for a 1,500 r tumor dose, the primary lesion is coagulated with diathermy. After three weeks, additional teleradium therapy is given (6,000 r tumor dose). If diathermy cannot be performed, interstitial implants may be used. The total (surface) dose, through three to five ports, may be as high as 15,000 to 20,000 r.

(6) Isolated *sarcoma of the skin or extremities* is treated through one to four ports for a tumor dose of 5,000 to 6,000 r.

(7) *Carcinoma of the tonsil and of the larynx* also respond well to teleradium therapy.

As a rule, treatment is given in daily doses of 350 to 500 r to one field, without noticeable general reaction. A total of 6,000 r surface dose to one port causes usually only an intensive erythema, seldom a wet dermatitis. This skin-saving effect can be explained by the predominantly forward scatter observed at this energy level. Isodose curves are given, and several cases are mentioned, with the statement that, under clinical conditions, teleradium therapy has proved to be the best treatment for selected cases.

Nineteen photographs; 5 graphs; 1 drawing.

E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

The Importance of Ultrasonics in Dermatology and Its Use for Skin Tumors in Combination with Roentgen Rays. Karlheinz Woeber. Strahlentherapie **98**: 169–185, September 1955. (In German)

Ultrasonic radiation effects are (*a*) local, such as hyperemia and changes in pH and colloid membrane, and (*b*) regional, in the form of a non-specific "irritation" over presumed vegetative nervous channels. In small doses, ultrasound is believed to have a stimulating effect on tissue metabolism. In heavier applications it is said to loosen sclerotic and otherwise callous connective and epithelial structures, which explains its use in physical therapy. Satisfactory results have been reported in various dermatoses.

The author has constructed for the treatment of superficial carcinoma a combination instrument head ("Kombikopf"), which contains an ultrasound generator (crystal) and is used at the same time as a port for the Chaoul type of irradiation. Insertion of the "Kombikopf" attenuates radiation by 48 per cent, but does not harden it significantly. With the 3.0-cm. tube (and 1.7 cm. "Kombikopf" thickness, *i.e.*, T.S.D. 4.7 cm.), a daily dose of 500 r was obtained in five minutes and fifteen seconds. With the 1.5-cm. tube (plus 1.7 cm. "Kombikopf," T.S.D. 3.2 cm.) the daily dose was increased to 660 r, to avoid reducing the concomitant daily ultrasound application below four minutes.

A series of twenty skin carcinomas (16 proved by biopsy) have been treated with the "Kombikopf" and, except for 1 case which required retreatment for a marginal recurrence, all were "apparently cured" after six to eighteen months. The dosages varied from 2,400 r (contact roentgen therapy) with 0.7 W/cm.^{2} (ultrasound) and 2,500 r with 0.3 W/cm.^{2} to 6,000 r with 0.2 W/cm.^{2} and 6,000 r with 0.4 W/cm.^{2}.

The tentative conclusion is expressed that addition of ultrasound application to roentgen therapy could allow reduction of the roentgen dose or potentiate the biologic effectiveness of conventional doses in the treatment of skin carcinoma.

Seven illustrations; 6 tables.

E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

Treatment of Malignant Melanoma and Pigmented Nevus. K. W. Kalkoff. Strahlentherapie **98**: 59–78, September 1955. (In German)

In the present state of our knowledge, a lesion suspected to be a malignant melanoma must not be biopsied because of the danger of spread by inadvertent opening of blood and lymph channels. Because of this fact the statistics of every author include a number of non-malignant conditions "cured" by the therapy under consideration. While there is a non-pigmented malignant melanoma (the main feature of which is the nevus cell and not the pigment), the error is usually the result of confusion with other pigmented skin lesions, such as (1) pigmented nevi, (2) pigmented precancerous dyskeratotic dermatosis or Bowen's disease, (3) pigmented extramammary ulceration resembling Paget's disease of the nipple, (4) pigmented basal-cell carcinoma, (5) pigmented squamous-cell carcinoma, (6) senile keratoma, (7) melanosarcoma, (8) melanosis circumscripta praecancerosa or Dubreuilh's disease, (9) granuloma pediculatum (pyogenicum or teleangiectodes), and (10) sclerosing angioma. In view of the fact that diagnosis must be based on appearance only, these cases should always be seen in consultation with an experienced observer.

A review of the literature indicates that in the United States wide surgical excision is the accepted form of treatment, while in Germany irradiation is more often favored, even though in both countries the five-year survival rates are comparable, varying, from author to author, between 25 and 50 per cent. The data improve if the cases without demonstrable metastases at time of treatment are singled out. In this paper, the opinion is expressed that results could be bettered by combining surgery and irradiation. The author recommends initial doses of 1,000 r daily, in the hope of preventing metastases during treatment, and then reduces this to 500 r daily. The total is no longer the 20,000 to 30,000 r (easily attained with contact therapy, but inevitably followed by local ulceration) occasionally still advocated, but only 25 per cent above the routine dose for squamous-cell carcinoma of the skin. At the completion of irradiation, the regional lymph nodes are biopsied. If deposits are found, extensive dissection is performed, with postoperative irradiation of the area. Excision of the original skin lesion does not appear justified if irradiation has been raised to the proper level.

Eight photographs; 5 photomicrographs.

E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

Carcinoma of the Fifth Toe. Report of Two Cases. Ole Anderson. Acta radiol. **44**: 83–86, July 1955.

The author reports 2 cases of cancer involving the skin and the bones of the fifth toe, in both of which the histologic diagnosis of parakeratotic carcinoma was made. In the second case there was extensive destruction of the distal and middle phalanges. Following amputation of the toe, numerous skin metastases appeared. Later there was metastasis to the lung, and death ensued. Preoperative irradiation was given in both cases.

The author comments on the fact that carcinoma so seldom affects the toes and cites Pack, who reported 124 cases of carcinoma of the fingers as against 4 of the toes. One reason is probably that the fingers are more exposed to sunlight and to chemical irritants.

One roentgenogram; 2 photographs; 1 photomicrograph.

JULIAN O. SALIK, M.D.
Baltimore, Md.

An Evaluation of the Treatment of Cancer of the Breast at the University of Edinburgh (Scotland), under the Direction of Dr. Robert McWhirter. Lauren V. Ackerman. Cancer **8**: 883–887, September–October 1955.

After having access to the University of Edinburgh records of the patients with carcinoma of the breast treated by simple mastectomy and irradiation (McWhirter) and surviving five years or longer, the author seeks to evaluate this mode of therapy. It is pointed out that survival rate alone is not a valid criterion for determining the treatment of choice since many variables are introduced, such as the pathologic diagnosis, the number of patients in early or late stages, variations in biological behavior of a given morphologic type of tumor, and failure to differentiate between "survival" and "cure." These factors plus the individual skill of the attending physician cannot be assessed. However, certain objective findings can be evaluated.

A review of the pathologic sections in the Edinburgh series revealed an error of only 2 per cent in the microscopic diagnoses, which does not influence the survival figures significantly. Perhaps a larger error was introduced in the clinical staging of the disease, which frequently was not done until after simple mastectomy. It is reasoned that lymph nodes that were clinically palpable following this operative procedure may well have represented hyperplasia secondary to the procedure rather than metastatic carcinoma. Thus, more patients were probably placed in the Stage II category than actually belonged there.

The author points out the undesirable radiation effects following treatment by simple mastectomy with subsequent external irradiation. Of 719 patients, 47 were said to show extensive radiation damage along with multiple fractures of the ribs, clavicle, and/or humerus, or fixation of the shoulder joint. In 3 instances, these changes were so severe that the arm had to be amputated. In many cases, minor effects from irradiation were noted, including pulmonary fibrosis, minor bone changes, and skin changes. These cases for the most part were from the earlier series and refinements in the roentgen technic have probably largely eliminated these undesirable effects.

It is the author's opinion that McWhirter's statement that axillary lymph nodes are more readily controlled by irradiation than the primary breast carcinoma is yet to be proved. In the group with persistent lymph node enlargement after radiation therapy, subsequent surgical removal in all instances showed cancer in the lymph nodes without detectable radiation effect.

Further, evaluation of simple mastectomy followed by axillary irradiation in this series is difficult, since at least 220 patients received a sterilizing dose of radiation to the ovaries regardless of the stage of their disease, and hormonal therapy was given freely. It is reasoned that these hormonal influences may have affected the survival time.

It is felt that the local effectiveness of a treatment may be evaluated by local recrudescence of disease. Stages I and II in McWhirter's series demonstrated a 16 per cent local recurrence rate.

Of the patients who survived a five-year period, 203 subsequently died. Practically no postmortem examinations were recorded, and only clinical impressions as to whether death was due to cancer or to intercurrent disease are available. Forty-four additional patients are living with persistent carcinoma. Again it is pointed out that "survival rates," as reported by McWhirter, and "cure rates" should be differentiated in evaluating a given therapeutic approach. Furthermore, from the standpoint of assessing the effectiveness of irradiation therapy, it is important to know whether persistent disease is present in a given survival group. If the number of patients with local or distant disease and those who have died are subtracted from McWhirter's five-year survival figures, his cure rate becomes low. Those patients who have survived without evidence of disease, who were originally in the Stage I or Stage II categories, may have had carcinoma limited to the breast and were possibly completely cured by the simple mastectomy procedure alone.

In conclusion, the author believes that his review of McWhirter's data indicates that (1) there is a considerable irradiation morbidity, (2) that many of the patients are not cured, (3) that a fairly high rate of local persistence exists, and (4) that sterilization of tumor in axillary lymph nodes is not proved (in fact a rather high percentage of mortality in Stages I and II suggests

the converse). Consequently, until further and more objective data are gathered, which would indicate that this form of therapy is in fact superior to radical mastectomy in the treatment of breast carcinoma, a plea is made for a continued acceptance of the latter procedure in properly selected cases.

Four tables.

JOHN W. WILSON, M.D.
University of Texas, Dallas

A New Method for Applying Radium in the Vagina in Cases of Carcinoma of the Uterine Cervix. Gray H. Twombly and Rieva Rosh. Cancer **8:** 1016–1020, September–October 1955.

Impressed by the variability in vaginal sizes and contours and the disadvantages of the many cervical radium applicators in current use, the authors have devised a vaginal mold (which is made individually for each patient) in which holes are drilled for placement of the radium. Such a mold permits precise geometric radium positioning and eliminates the need of vaginal packing. The fixed distances that can be maintained between the radium sources and the rectum and bladder, and the rigid placement of the sources relative to the tumor-bearing area, are other obvious advantages.

The mold is prepared with the patient in a knee-chest position. A dental impression cream, an alginate, is introduced into the vagina with a caulking gun *via* a perforated Lucite tube. The alginate hardens, forming a cast of the vaginal cavity. After removal of the cast, an impression of it is taken in plaster of Paris. The plaster impression is then filled with acrylic. The acrylic mold is drilled to house the radium tubes and serves as the radium applicator.

Four figures.

JOHN W. WILSON, M.D.
University of Texas, Dallas

Recurrence of Cancer of the Uterine Cervix after Five-Year Cure. B. Belonoschkin. Acta radiol. **44:** 57–82, July 1955. (In German)

Statistical reports pertaining to the treatment and cure of carcinoma of the cervix are ordinarily based on a five-year follow-up system. The author became interested in the fate of women who were classified as five-year cures and investigated the frequency of late recurrence, late metastasis, and the appearance of new and so-called "double carcinomas." His material was derived from 4,396 cases treated at the Radiumhemmet, Stockholm, during the years 1914 to 1941, of which 1,330 were classified as five-year cures.

A mass appearing at the site of the primary tumor and having the same histologic characteristics is considered a *local recurrence*, provided it was not observed on at least two examinations during the first six months after the institution of treatment. Twenty-four patients had one or more of such masses in the cervix, body of the uterus, fornices, or upper third of the vagina. Three of these patients had, in addition to the local recurrence, a second carcinoma. Nine patients had recurrences in the lower two-thirds of the vagina and 92 had recurrences in the parametria. The stage distribution in the latter group was as follows: Stage I, 13 cases; Stage II, 47 cases; Stage III, 25 cases; Stage IV, 7 cases. The total number of recurrences was 125, representing 9.4 per cent of the 1,330 five-year cures.

The appearance of a mass or masses caused by blood borne or lymph borne *metastases* was seen in 23 cases, involving the skeleton in 10 cases, the lungs in 6, the ovaries in 5, and lymph nodes in 2. Some of these patients had multiple metastases which were found on autopsy or additional examinations.

The author classifies as a *new carcinoma* a mass arising on the primary site but histologically different from the previously healed carcinoma. Eight such cases were found.

Different carcinomas present in other parts of the body, in addition to the healed or persistent primary lesions of the cervix, classified as *double carcinomas*, were found in 61 patients.

Evaluating his material, the author shows that 16.3 per cent of patients having five-year cures, or 4.9 per cent of the total number of those operated upon, had some form of cancer. He agrees with Warren and Gates that in some patients carcinoma is likely to develop more readily than in others, possibly due to a kind of constitutional disability which is characterized by a definite predisposition to cancer.

Fourteen photomicrographs; 2 tables.

JULIAN O. SALIK, M.D.
Baltimore, Md.

Malignant Tumors of the Ovary. Geoffrey A. Gardiner and Jean Slate. Am. J. Obst. & Gynec. **70:** 554–562, September 1955.

A series of 96 cases of carcinoma of the ovary seen at the White Memorial Hospital (Los Angeles) between the years 1936 and 1949 has been reviewed for evaluation of therapeutic results. Surgical treatment alone was compared with surgery plus postoperative irradiation.

The clinical stage of the disease was found to be the most important factor affecting prognosis. The five-year survival rate for the series was 32.3 per cent. This rate has not changed essentially during the past two decades, and the authors feel it will remain unchanged as long as the majority of patients are seen for the first time in the more advanced stages of the disease.

The surgical treatment of choice for ovarian cancer is bilateral salpingo-oophorectomy with total hysterectomy; if that proves impossible, an attempt should be made to remove the primary lesion even though the disease had spread beyond the ovary. In inoperable cases, a biopsy should be done. In the series reported, radiation therapy was usually begun one or two weeks following surgery. Factors were: 200 kv, 15 ma., 50 cm. target-skin distance, and 0.5 to 1.0 mm. copper filtration (h.v.l. 1.07 to 1.6 mm. Cu). In general, two anterior and two posterior 10 × 15-cm. fields were used. In 25 per cent of the cases lateral fields were added, with a slight improvement in five-year survivals. Generally 200 r (air) was given to two fields daily, to a total of 2,000 to 2,400 r (air) to each field.

Of 64 patients treated by surgery alone, 22 were alive at the end of five years. Most of these when first seen had Stage I lesions. Of 53 patients given postoperative radiation, 17 were alive at the end of five years. In most of these the disease was of Stage III when diagnosed.

From these results it appears that postoperative irradiation definitely increases the survival rate in patients in whom all the tumor cannot be removed at surgery.

Two graphs; 7 tables.

R. L. EGAN, M.D.
University of Texas, Houston

Discussion on the Pathology and Treatment of Functioning Ovarian Tumours and Other Unusual Growths of the Ovary. C. W. Taylor, G. Douglas Matthew, and G. W. Blomfield. Proc. Roy. Soc. Med. **48:** 721–735, September 1955.

This is an excellent discussion of a "special" group of ovarian tumors, with the report of numerous illustrative cases, by a pathologist, a gynecologist, and a radiotherapist. In an earlier study, the pathologist had found this "special" group to constitute 4.6 per cent of a series of 808 ovarian neoplasms seen at the Women's Hospital, Birmingham (England), over a ten-year period (Taylor: J. Obst. & Gynaec. Brit. Emp. **57:** 328, 1950). The tumors included were granulosa-cell tumors (18), theca-cell tumors (7), arrhenoblastomas (3), dysgerminomas (3), and Brenner tumors (6). The granulosa-cell and theca-cell tumors are "feminizing"; the arrhenoblastomas "masculinizing." A second, less common masculinizing growth is the lipoid-cell tumor. The pathogenesis of various members of the group is discussed concisely.

The clinical features of the estrogenic ovarian tumors (granulosa-cell, theca-cell, and combined granulosa-cell and theca-cell type) are discussed by Matthew. Generally speaking, symptoms depend upon the age of the patient, the estrogenic effect of the neoplasm, its size and nature (whether malignant or benign), and such complications as torsion of a pedicle or rupture. Additional symptoms may be attributable to associated conditions, as endometriosis, uterine fibroids, carcinoma of the breast or of the endometrium. Irregular uterine bleeding is commonly but not invariably a feature.

Blomfield reports the results of treatment obtained in the Radiotherapy Centre, Sheffield. Of 216 patients treated between 1943 and 1952, 102 died within a year of the institution of treatment; there were 64 subsequent deaths, and 50 patients were alive at the time of the report, 5 with recurrences. The overall five-year survival rate is given as 18 per cent. Blomfield says in conclusion:

"....functioning tumours of the ovary form a relatively uncommon but important group. Amongst these tumours varying degrees of malignancy are met with but even taking the malignant functioning growths as a whole, they have a much more favourable prognosis than the ordinary carcinomas of the ovary which are commonly met with. They yield better to radical surgery, and certain types, such as the dysgerminoma, are particularly responsive to radiotherapy.

"Supervoltage X-ray therapy has advantages over X-ray therapy at lower energies for these tumours, as it has for other deep-seated tumours, and would appear to be all the more desirable on account of the very good chance of controlling these growths."

This is an excellent panel discussion, to which an abstract can do only scant justice. One of the points stressed is the difficulty of an exact diagnosis. A review of the initial slides may lead to a change of opinion after the lapse of several years.

Four photomicrographs; 1 chart; 8 tables.

JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Radiotherapy of Bladder Cancer by Means of Rubber Balloons Filled in Situ with Solutions of a Radioactive Isotope (Co^{60}). J. H. Müller. Cancer **8:** 1035–1043, September–October 1955.

This report on cobalt therapy of carcinoma of the bladder is essentially similar to one by the same author, previously abstracted in Radiology (Radiol. clin. **23:** 285, 1954. Abst. in Radiology **65:** 151, 1955). The procedure described consists in the introduction into the urinary bladder of radioactive cobalt in liquid form by means of a Bardex balloon catheter. Five-year results were not available, but 41 per cent of 96 patients were reported free of disease after three and a half years. For details of the technic and indications, see the earlier abstract.

Four illustrations; 6 tables.

Calculation of Absorbed Dose in the Patient from the Measured Exposure in Air. G. N. Whyte. J. Canad. A. Radiologists **6:** 39–40, September 1955.

Exposure rate, which is measured in r/min, is a property of the radiation only. It is related to the gamma ray intensity; in fact, for a fixed energy spectrum, the exposure rate is proportional to the intensity. *Absorbed dose* in the patient, on the other hand, is a quantity proportional to the energy absorbed per gram of tissue. A tumor dose of so many r presumably means that the tumor has absorbed an energy per gram equal to that lost by a roentgen, *i.e.*, a rep.

The distinction between absorbed dose and exposure is illustrated by the "build-up" portion of the depth dose curve for Co^{60}. The exposure is greater at the skin than at a depth of 0.5 cm., but the absorbed dose at the skin is less than at 0.5 cm.

Since isodose curves are available, the present problem is reduced to finding the absorbed dose rate at the maximum of the depth-dose curve in terms of the exposure rate in free air at this point. A chamber with a small air volume and an equilibrium wall of about the same density as the phantom was used to measure the two values for field sizes from 5×5 to 20×20 cm. and a table of conversion factors is given. These apply to a source-skin distance of 80 cm., but should not be in error by more than 1 per cent for distances between 60 and 120 cm.

Two figures; 1 table.

LUCILLE DU SAULT
Henry Ford Hospital

RADIOISOTOPES

Radioisotope Studies of the Physiology of Calcified Tissues. Wallace D. Armstrong. Minnesota Med. **38:** 618–622, September 1955.

Studies with radioisotopes have demonstrated that the bone mineral is not static but is in a state of flux, the elements being constantly removed and replaced. An important physiologic concept has been contributed by such studies, namely, that the skeleton plays an important function in regulating the ionic composition of body fluids.

By rapidly injecting radioactive calcium, or both calcium and sodium, intravenously into dogs and taking frequent blood samples thereafter, the author determined the rapidity with which calcium was removed. The concentrations of the radioisotopes in the plasma fell rapidly, that of calcium more rapidly than that of

sodium, and the concentration of radiocalcium continued to fall long after an equilibrium concentration of radiosodium in the plasma had been reached. This fall in concentration is attributable to movement of the labeled ions to interstitial fluid and thence to bone. Exponential curves were obtained for each of the two ions.

It was further shown that in 150 minutes the skeleton of a 20-kg. dog had exchanged about 1 gm. of calcium and about 8.2 gm. of sodium.

By studying bone with radioisotopes, light was shed on its remodeling. It was found that this occurs through formation and maturation of haversian canals and by recrystallization of the bone mineral.

Turnover of calcium in the bones of rats was also studied and retention curves are reproduced.

Radioactive phosphorus and calcium, when given to animals, are found also in the dentin and enamel, though in much smaller amounts than in the bones. Enamel receives its calcium from both the dentin and through the surface directly from the saliva.

Three radioautographs; 3 diagrams; 4 tables.

ALEXANDER R. MARGULIS, M.D.
University of Minnesota

Isotope Techniques for Mediastinal Tumors. Robert D. Swedenburg, William M. Tuttle, and K. E. Corrigan. Arch. Surg. **71**: 372–382, September 1955.

In the opinion of the authors, a single tracer study, or at the most a sequence of two, will serve to divide all mediastinal tumors into three general groups preoperatively: (1) thyroid, (2) new growths with increased cellular activity, and (3) benign growths or anatomical abnormalities. The tracers can be used effectively to locate involved tissue that may otherwise be overlooked, and thus aid in planning the surgical approach to the lesion.

Iodine (I^{131}) tracer studies should be conducted first. Radioactive phosphorus (P^{32}) is used as a standard tracer, if doubt still exists after the use of iodine (I^{131}). P^{32} is concentrated rapidly by fast-growing malignant lesions. The technic for each of these studies is briefly described.

Five cases are reported, representative examples from a large series in which tracers were used for localization and diagnosis.

Sixteen roentgenograms; 2 photographs; 5 tracer maps.

JULIAN S. LEWIS, M.D.
Cleveland City Hospital

Pitfalls in Diagnostic Use of Radioactive Iodine. Solomon Silver, Stephen B. Yohalem, and Robert A. Newburger. J.A.M.A. **159**: 1–5, Sept. 3, 1955.

This study, which is concerned with the blind use of tracer doses of I^{131} in the diagnosis of thyroid disorders, is based on 113 patients found by at least two clinicians to be euthyroid. Whenever possible, the serum protein-bound iodine (stable) level and basal metabolic rates were employed as laboratory aids in confirmation of the clinical diagnosis. Following administration of tracer doses of I^{131}, both the uptake by the thyroid and the amount of protein-bound I^{131} in the plasma were determined. In all cases either the uptake study or the protein-bound serum I^{131} values or both were in a range generally accepted as indicating hyperthyroidism. Three groups of cases were identified: (1) those with high uptake values but with normal blood levels of protein-bound I^{131} (33 patients); (2) those with a normal thyroid uptake but with elevated protein-bound I^{131} levels in the plasma (51 patients); (3) those in which both measurements were elevated (29 patients).

A somewhat detailed report of the literature with respect to the elevated tracer studies in euthyroid patients is presented.

In this series, high thyroid uptakes but normal protein-bound I^{131} determinations were obtained chiefly in patients with non-toxic nodular or non-toxic diffuse goiter; patients on low-salt diet; patients non-goitrous after discontinuation of propylthiouracil; patients non-goitrous after discontinuation of thyroid extract therapy; patients with no thyroid lesion. Patients showing elevation of protein-bound I^{131} or elevation of both the thyroid uptake study and protein-bound iodine were chiefly those who were previously hyperthyroid and were treated primarily with I^{131}. A table is presented listing the details of this evaluation.

The authors fear two pitfalls if tracer studies are accepted unreservedly: 1. Euthryoid patients may be treated unnecessarily. 2. Hyperthyroid patients adequately treated may be further treated and rendered myxedematous. It is felt that in cases previously treated with I^{131} the best guide for further treatment is the clinical status. The basal metabolism rate and protein-bound iodine (stable) level are recommended as laboratory aids. I^{131} tracer studies are considered the least valuable in these patients.

Possible explanations of the mechanism of the high tracer uptakes in euthyroid individuals are considered. The authors feel that the most likely explanation is a decrease in the total miscible iodide pool, that is, essentially a decrease in the iodide concentration in the total body water, while the most likely explanation of the high blood levels of protein-bound I^{131} is the occurrence of a reduced hormonal iodine pool in the gland.

One table.

F. F. RUZICKA, JR., M.D.
St. Vincent's Hospital, N. Y.

The Problem of Thyroid Function Tests with Radioiodine in Iodine-Deficient Communities. O. Eichhorn. Schweiz. med. Wchschr. **85**: 879–882, Sept. 10, 1955. (In German)

This paper originates from the University of Graz (Austria), which lies in a notoriously iodine-deficient region, where endemic goiter is rampant. The conventional methods of testing thyroid function with I^{131} failed completely there. The mean uptake was 57 per cent in normal subjects, 68 per cent in hyperthyroid patients, and 61 per cent in patients with noduluar goiter (hypothyroid).

In order to minimize the influence of thyroid gland volume, the author used a glass model of the thyroid for precalibration of the counter and as comparison standard for physical decay during the test period. Urine excretion values were of no greater use than uptake readings.

The author resorted then to a radioactive iodine plasma test. The 48 hour/2 hour reading represented an index which was correlated to the clinical diagnosis. While it is true that this "activity index" showed a good correlation to the clinical status of the thyroid gland, it was felt that the test was still useless because it was not capable of making a distinction between normal and abnormal in clinically difficult cases, *i.e.*, the test failed when it was most needed. The "activity index" was considerably higher in this community than in areas in which iodine is abundant. Apparently all thyroid

glands were so starved of iodine that they stored the test dose with a rapidity otherwise seen only in hyperthyroidism.

Finally, the author supplemented this procedure by a chemical separation of the protein-bound serum iodine from the inorganic serum iodine at forty-eight hours. It turned out then that radioactivity was still found in the de-proteinized serum fraction except when marked hyperthyroidism was present. (This is contrary to observations made in communities with adequate iodine supply.) In mild hyperthyroidism the protein-bound iodine was on the average 80 per cent, in normal subjects 60 per cent, and in nodular goiter below 60 per cent; when nodular goiter was associated with cretinism, the figure was between 12 and 50 per cent.

The failure of radioiodine tests in iodine-deficient communities lies apparently in the erroneous assumption that all administered iodine which is found in the serum after forty-eight hours must have become protein-bound. This may be true in communities with adequate iodine supply, but is not the case in the community in which the test was conducted. In iodine-deficient communities, it is necessary to combine the plasma index of radioactivity with the determination of residual serum activity after removal of all protein-bound iodine if one wishes to arrive at a reasonably accurate diagnosis. In order to facilitate such a double test, the author has now increased his test dose of I^{131} to 80 to 100 microcuries.

Two tables. GERHART S. SCHWARZ, M.D.
New York, N. Y.

Iodipamide (Cholografin) Administration. Its Effect on the Thyroid Uptake of I^{131} and the Serum Precipitable Iodine in Euthyroid Persons. Wayne R. Rogers and Leonard R. Robbins. New England J. Med. **253:** 424–425, Sept. 8, 1955.

Seven euthyroid patients, 6 of whom had previously undergone cholecystectomy, were given 40 to 60 c.c. of a 20 per cent aqueous solution of iodipamide (Cholografin) intravenously. As with iodoalphionic acid (Priodax), iodopyracet (Diodrast), and iodinated oil (Lipiodol), there was a significant decrease in the uptake of I^{131} by the thyroid beginning in the first week following the injection and lasting for an average of three months. All of these contrast media also cause an elevation of the serum-precipitable iodine for about three months without increasing the serum inorganic iodides. These important tests for thyroid function must then take into consideration prior administration of another iodide-liberating substance, iodipamide (Cholografin or Biligrafin). SAUL SCHEFF, M.D.
Boston, Mass.

Studies of the Distribution of Radioactive Colloidal Gold in Regional Lymph Nodes Containing Cancer. William B. Seaman and William E. Powers. Cancer **8:** 1044–1046, September-October 1955.

Since radioactive colloidal gold has been shown experimentally to concentrate in both normal and tumor-bearing lymph nodes, it was reasoned that it could be used for the treatment of cancer-containing nodes. First, however, it is necessary to show that there is a consistent uptake in tumor-bearing nodes and that the levels of radioactivity are sufficient to be therapeutically effective.

The authors injected colloidal gold into normal breast tissue adjacent to a tumor in women about to undergo radical mastectomy. Tracer amounts from 1 to 3 millicuries were used. The axillary nodes were dissected from the surgical specimen, and radioactivity was determined by a scintillation counter. The activity was then correlated with the histologic findings.

A total of 356 nodes were removed from 12 patients. Of these, 293 were normal and only 123 of this number showed evidence of radioactivity. Sixty-three nodes contained cancer, and radioactivity could be detected in only 20 of these, the amount of activity being apparently proportionate to the volume of remaining normal lymphoid tissue. Radioautograms demonstrated the radioactivity to be limited to the normal lymphoid tissue; nodes which were completely replaced by tumor did not collect the radioactive colloid.

This study indicates that radioactive colloidal gold is taken up only by the normal lymphoid tissue and any irradiation of tumor-bearing tissue is secondary. The short range of the beta particles emitted by the radioactive gold precludes adequate irradiation of the cancer-bearing area in the lymph node, depending of course upon the volume of the cancer deposits. However, cancerocidal radiation can be obtained from the gamma emission without dependence upon the beta component. Nevertheless, the absence of any actual deposit of the radiogold in the cancer-bearing portion of the nodes makes the interstitial injection of this isotope an unreliable procedure in the treatment of regional lymph node metastases.

Five radioautographs. JOHN W. WILSON, M.D.
University of Texas, Dallas

Treatment of Bladder Growths by a Solid Intravesical Cobalt Source. D. G. Bratherton. Brit. J. Radiol. **28:** 508–513, September 1955.

The ideal and most effective method of radiotherapy for the early malignant lesion of the bladder is the implantation of the tumor base with radioactive material, with the bladder open. This approach is not applicable, however, to multiple lesions, which in the past had to be treated by deep x-ray therapy. However, the rays must pass through small bowel and rectum, which tolerate radiation badly, and high doses produce tenesmus, colic, and diarrhea. To spare the patient these discomforts, intracavitary irradiation has been used. The question was whether to use a solid source of radiation or to fill the bladder with radioactive liquid. The first method is discussed in this article. Its advantages are as follows: (1) Protection is much easier since the material cannot spill and contaminate bed-clothes. (2) The solid source, radium or cobalt, is always ready for use. (3) A central source gives the best possible depth dose. The major difficulty of the method is to ensure that the source remains centrally placed in the bladder.

The author uses a cobalt source which is held in position in the bladder inside an elastic latex balloon. The balloon is carried on a metal catheter which has a double channel—one for inflating the balloon and a larger one for carrying the radioactive cobalt slug. Two such slugs were used, each of 80 mg. radium equivalent, permitting a dose of 3,000 r to be given on the surface of a sphere of 150 cm. in twenty-four hours. The insertion is repeated one week later, with another dose of 3,000 r, making a total dose of 6,000 r on the surface of the bladder.

The method is suitable only for cases where the spread of tumor is superficial rather than deep. Any considerable infiltration of the wall of the bladder is un-

likely to receive a dose of radiation and no case has been included if an extravesical infiltration has been palpable on rectal examination. Eight of 16 patients with malignant tumors are alive after two years, 3 having required further surgery. Papillomas are rarely completely cured, but are reduced in size and can once again be controlled by cautious diathermy.

Three roentgenograms; 1 photomicrograph; 5 photographs; 1 diagram; 3 tables.

JOACHIM GROELLER, M.D.
Cleveland City Hospital

Calibration of Cobalt-60 Using Absolute Ionization Measurements. H. E. Johns, D. V. Cormack, and G. F. Whitmore. J. Canad. A. Radiologists **6:** 37–38, September 1955.

Several carbon chambers having volumes from about 1 to 2.5 c.c. and aluminum chambers with volumes of about 1 and 2.5 c.c., all with wall thickness slightly greater than that required to produce maximum ionization current, were used to determine the output of a 1,000-curie Co^{60} beam by measuring the absolute ionization current produced. Measurements were corrected for temperature and pressure, and also for wall attenuation and stopping power of the wall material. Values obtained over a period of six months are listed in a table. For comparison, these were all corrected to the same time, the average being 24.4 r/min. with a standard deviation of 0.2 r/min.

It is estimated that dosage rate determined in this way should be accurate to ±1 per cent.

Two diagrams; 1 table. LUCILLE DU SAULT
Henry Ford Hospital

Calibration of Cobalt Units Using Radium as a Standard. C. Garrett and W. H. Henry. J. Canad. A. Radiologists **6:** 35–36, September 1955.

A 25-r Victoreen chamber with a 3-mm. Lucite cap was calibrated against a 250-mg. radium source encased in 1 mm. of silver, whose output had first been determined by two methods, with results agreeing within 0.5 per cent.

Owing to the necessity of measuring outputs of large sources, of the order of kilocuries, it was considered advisable to use a 500-r chamber in order to obtain accurately measurable exposure times. Such a chamber was made by replacing the usual Victoreen 25-r thimble by a Lucite thimble of 3 mm. wall thickness and appropriate volume. This chamber was calibrated by comparing its response with that of the 25-r chamber.

The estimated errors of calibration were 1 per cent for the 25-r and 1.7 per cent for the 500-r chamber.

The 500-r chamber was used to measure outputs of cobalt units across Canada, and in many cases these were found to be higher than the values previously in use, the difference being as great as 10 per cent. This was due, in part, to the assumption that the Victoreen calibration factor was the same on x-rays and on cobalt gamma rays.

All cobalt units in use in Canada are now calibrated on the same basis, and it should be possible to compare results at different centers with considerably more confidence. LUCILLE DU SAULT
Henry Ford Hospital

The Differential Absorption of Radioactive Isotopes in Artificially Constructed and Normal Bladders in Dogs. Horace D. Marucci. Surg., Gynec. & Obst. **101:** 285–289, September 1955.

Shoemaker and Gratzinger and their associates (Ann. Surg. **140:** 832, 1954; J. Urol. **73:** 314, 1955) have previously described the reconstruction of canine urinary bladders with inverted seromuscular grafts from the intestinal tract. Their studies indicate that such a reconstructed organ becomes lined with a transitional-cell epithelium and is morphologically indistinguishable from the normal urinary bladder epithelium.

In the present study, radioactive tracers (iodine, phosphorus, and sodium) were used to test the absorption of bladder mucosa in 15 mongrel male and female dogs, weighing 12 to 15 kg. Five dogs (with normal bladders) were used as controls; 5 dogs had bladders reconstructed with seromuscular grafts (as described above); in the remaining 5, the bladders were reconstructed as above except that the mucous membrane of the ileum was preserved and placed on the luminal aspect of the reconstructed organ.

All animals were anesthetized with sodium pentothal, the bladder was washed with sterile water, and the radioactive isotope instilled. Control blood and urine samples were taken at the beginning of the study. Twenty-five microcuries of radioactive iodine were placed in the bladder of each of the 15 dogs; 5 microcuries of radioactive sodium were used in each of 13 dogs, and 50 millicuries of radioactive phosphorus in each of 9 dogs. Blood plasma samples were taken at frequent intervals for radioactive assay.

In both the normal bladders and the seromuscular reconstructed bladders, only minimal quantities of each of the radioactive isotopes were transported across the mucosa to the blood stream. In the reconstructed bladders lined with intestinal mucous membrane, however, there was rapid absorption of each of the radioactive isotopes over the two-hour period of observation.

These results indicate that the transitional-cell lining of the seromuscular bladder grafts is physiologically as well as morphologically indistinguishable from the normal according to the technics used in this study.

Six graphs. HENRY P. PENDERGRASS, M.D.
University of Pennsylvania

RADIATION EFFECTS

The Hazards of Surgery in Irradiated Tissue. David W. Robinson. Arch. Surg. **71:** 410–416, September 1955.

Surgical procedures contemplated in tissues previously subjected to irradiation may be performed with good wound healing, but also may be followed by serious complications which cause poor end-results, require prolonged hospitalization, and even threaten life.

Some of the complications that make surgery in irradiated tissue more difficult and hazardous are: (1) infection; (2) poor healing; (3) slough; (4) exposure of important structures; (5) difficult hemostasis; (6) difficult dissections; (7) spread of carcinoma released from the incarceration of fibrosis; (8) radio-osteonecrosis; (9) induced tissue allergies; (10) pain leading to narcotic addiction; (11) general inanition. The author discusses each of these briefly and states that all are fundamentally the result of diminished blood supply.

lowered vitality of the irradiated tissue, and excessive fibrosis.

Among the more important surgical aspects mentioned are excision of devitalized tissues, skin and pedicle grafting, and the prevention of infection. An excellent discussion follows the article.

Fifteen photographs. JULIAN S. LEWIS, M.D.
Cleveland City Hospital

Radiation Stricture of the Small Intestine. Raymond E. Anderson, Leon J. Witkowski, and Guy V. Pontius. Surgery **38**: 605–609, September 1955.

Injury of the intestinal tract is not an uncommon complication of irradiation of the abdomen or pelvis, having been reported in as high as 16.9 per cent of patients treated for carcinoma of the cervix. In 75 to 90 per cent of cases the injury involves the distal portion of the large bowel. Damage to the small intestine, when it occurs, is almost always limited to the terminal 4 to 6 feet of ileum and is most commonly at the ileocecal junction. Only 7 cases of involvement of the jejunum have been recorded in the American literature in the last thirty years, and in each the jejunal injury was an extension of a process from a more distal segment of the intestinal tract. Massive necrosis, intoxication, and death occurred in the early postirradiation period in every instance.

The authors present a case of radiation stricture of the proximal jejunum manifest seven years after therapy (exact amount of irradiation not known). As far as they can determine, this is the first case of injury to the intestinal tract of this type to be recorded. Surgical resection of the lesion relieved all symptoms, and at the time of the report the patient was in good health, nine months after operation.

One photograph.

Total-Head (Brain) X Irradiation of Mice and Primary Factors Involved. Herman C. Mason, Beryl T. Mason, and Walter S. Moos. Brit. J. Radiol. **28**: 495–507, September 1955.

In this paper the authors report the susceptibility of white Swiss mice to a single dose of total-head x-irradiation. The effects of 22 MEV betatron and 200 kvp x-irradiation were compared in order to evaluate the LD 50/30 (dose that will kill 50 per cent of mice within a thirty-day period, or that amount of x-irradiation that will allow survival of 50 per cent of the mice for at least thirty days) of total brain tissue irradiation. The doses were 500 to 4,000 r by betatron x-ray beam and 500 to 3,500 r by 200-kvp x-rays. A total of 40 mice was used to establish each x-irradiation dosage effect, and 48 mice were used to establish each LD 50/30 level. For betatron x-irradiation, the LD 50/30 was found to be 1,600 to 1,650 r; for 200-kvp x-irradiation 1,250 r.

Bacterial studies of the heart blood were performed on 79 mice, but only 3 positive cultures were obtained. A leukocytosis occurs, which is in contrast to results obtained by whole-body x-irradiation. White and red cell counts were not depressed. Where an elevation in the blood count was found, there were also dehydration and blood concentration. Surprisingly, no eosinophilia occurred, though this would be expected because of the possible stimulation of latent tissue parasites, viruses, bacteria, or other agents.

Weight loss was recorded for doses of 1,550 r and more. The critical weight loss occurred during the first week, extending into the second.

Death is not induced by any single means. It is a cumulative effect upon the central nervous system and apparently other tissues, without primary bacterial effects. Total-head x-irradiation at the LD 50/30 level induces (1) hemorrhage of the brain; (2) dehydration and its effects upon the hemopoietic system and gastrointestinal tract, (3) delayed pneumonia of various types, (4) weight loss, (5) hair loss in the area irradiated, and (6) possible adrenal and other organ effects. The degree of injury by irradiation is a function of the dose.

Four graphs; 11 tables. JOACHIM GOEBLLER, M.D.
Cleveland City Hospital

Experimental Ocular Effects of High-Voltage Radiation from the Betatron. Albert C. Biegel. Arch. Ophth. **54**: 392–406, September 1955.

The betatron is advantageous for studies of ocular radiation changes because of its depth-dose characteristics. Nearly uniform dosage may be obtained throughout the eye; or, if so desired, the dose in the anterior segment may be made quite low relative to that in the posterior segment. The author describes an investigation of the clinical and histologic effects of irradiating the rabbit eye with 16–19 MEV electrons and 23 MEV x-rays produced by a 20,000,000 volt betatron. Conditions were so arranged that the dose was approximately the same for all depths, so that relative susceptibilities of various portions of the eye could be assessed.

Most of the ocular changes observed in the present experiment are in agreement with those cited by other workers using lower-voltage radiation. Posterior subcapsular opacities were seen clinically, and corresponding changes were noted histologically, four to six months after doses as low as 225 r. The sequence of events in the morphology of cataract development following irradiation is described in detail. Cells resembling conjunctival goblet cells were found in the corneal epithelium after high-dosage irradiation. There were two phases of inflammation: the first, an early transient uveitis after doses as low as 1,650 r; the second, a delayed keratitis with anterior segment inflammatory change after doses of 2,700 r or more. Granulomatous change in the vitreous occurred after doses of 1,800 r and above. A mild hypotony four months after high-dosage irradiation was demonstrated with the aid of general anesthesia and biometric analysis. Slight change in the sensient layer of the peripheral retina was observed after higher doses. No changes in the sclera and optic nerve were demonstrable by ordinary histologic technic. Neither portal size nor type of beam (x-ray or electron) appeared to influence the effects of the irradiation on the rabbit eye.

Eleven figures.

Reparation of the Fetal Eye Following Radiation Insult. Roberts Rugh and Joan Wolff. Arch. Ophth. **54**: 351–359, September 1955.

Fetal CF_1 mice were exposed on gestation day 12.5 to x-rays in doses ranging from 50 to 300 r, and the eyes were examined at four, twenty-four, and seventy-two hours and at six days and six weeks thereafter to determine the cytological changes produced by the irradiation.

The greater the radiation insult, the earlier the evidence of cytological radionecrosis.

An exposure of 50 r had no discernible effect. An exposure of 150 r caused extensive retinal radionecrosis within twenty-four hours after irradiation, but this had

cleared up at seventy-two hours. An exposure of 250 or 300 r caused about half of the presumptive retinal cells to break down or become pyknotic by four hours after irradiation. With this exposure, the damage was so extensive that cells continued to break down as they attempted mitosis, and the active phagocytes were unable to clear up the debris until about seventy-two hours after exposure.

All fetal eyes exposed at 12.5 days to any level of radiation used appeared to be fully "repaired," or the retina was "reconstituted," by seventy-two hours after exposure. While all exposed retinas were "reconstituted," they gave evidence of persistent damage in the form of microphthalmia. The volume of the eyes exposed to 250 r during fetal life was approximately 50 per cent of the volume of control eyes at the adult stage of six weeks. The retina was not proportionately reduced in thickness.

While the early fetal eye is extremely radiosensitive, it exhibits remarkable powers of repair and reconstitution. Whether the eye is functionally altered has yet to be determined.

Twenty-eight photomicrographs; 2 photographs.

The Effect of Cysteamine, Cystamine and Hypoxia on Mortality and Bone Marrow Chromosome Aberrations in Mice after Total Body Roentgen Irradiation. Finn Devik and Francis Lothe. Acta radiol. **44**: 243–248, September 1955.

Cysteamine (beta-mercaptoethylamine) [called also "cysteinamine" by W. M. Court Brown in Brit. J. Radiol. **28**: 325–326, June 1955] and cystamine have been shown to exert a protective effect against death following x-ray irradiation. To determine whether they might also protect against radiation-induced chromosome aberrations, they were given to 154 mice prior to 1,100 r and 110 mice prior to 200 r total-body irradiation.

In terms of protection against death and also against bone marrow chromosome aberrations, the chemicals were effective. The effect was enhanced somewhat by inducing hypoxia during and after the exposure.

One diagram; 2 tables.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Delayed Gastric Emptying in Rats after Whole and Partial Body X-Irradiation. Marguerite N. Swift, S. Tom Taketa, and Victor P. Bond. Am. J. Physiol. **182**: 479–486, September 1955.

Using a quantitative dye procedure, Goodman, *et al.* (Am. J. Physiol. **169**: 242, 1952. Abst. in Radiology **60**: 327, 1953) showed that gastric retention rather than altered intestinal motility is responsible for the marked reduction in amount of material available for intestinal absorption after minimal lethal doses of radiation. This finding suggests that the gastric emptying rate may play a significant role in postirradiation digestive function, and focuses attention on this particular phenomenon as a radiation response. Experiments carried out by the authors were designed to quantify this response as a function of body region exposed, amount of tissue exposed, and radiation dosage.

A measure of the efficiency of gastric emptying in rats immediately following whole- and partial-body x-irradiation was obtained by weighing the normally ingested gastric contents of animals killed at the time of, and at one or more intervals after, exposure.

The data obtained following whole-body exposure indicate that gastric emptying time increases with dosage. A borderline effect was demonstrable six hours after 25 r, and a three-fold increase in overall emptying time occurred after 150 r. Lethal irradiation (900 r) resulted in progressive distention of the stomach with fluid, with essentially no indication of propulsive motility throughout the three-day experimental period.

The body regions most "radiosensitive" with respect to producing the inhibition were head and abdomen. Gastric emptying was of the order of 50 per cent of normal following 200 r to the head, or to transverse segments of the upper or lower abdomen whereas this dose had no effect following exposure of the thoracic region or hindquarters (10–12 per cent of total-body weight irradiated in each instance). Some degree of inhibition was obtained by irradiation of hind legs and tail with a higher dose (1,000 r).

Five charts; 3 tables.

Effect of X-Radiation on the Flow of Perfusion Fluid Through the Isolated Rabbit's Ear. Herbert B. Gerstner, Phillips M. Brooks, and Sidney A. Smith. Am. J. Physiol. **182**: 459–461, September 1955.

The object of the investigation described by the authors was to demonstrate immediate radiation effects on the blood vessels of the isolated rabbit's ear. Perfusion flow rate, protein release, and edema formation (weight changes) were measured in 100 rabbit ears perfused with Tyrode's solution at 24° C. under a pressure of 24–25 mm. Hg. Fifty of the ears were irradiated with from 1 to 8 kr; the remaining 50 served as controls. Irradiation caused an immediate but transitory reduction of flow rate; the effect became more striking the higher the dose. Irradiated ears showed a marked protein washout that could be demonstrated by addition of sulfosalicylic acid to the perfusate. The weight gain caused by the perfusion with colloid-free solution disclosed no significant difference between controls and irradiated ears.

One graph.

Effects of Whole Body X-Irradiation on 17-Hydroxycorticosteroid Levels, Leukocytes and Volume of Packed Red Cells in the Rhesus Monkey. A. B. French, C. J. Migeon, L. T. Samuels, and J. Z. Bowers. Am. J. Physiol. **182**: 469–476, September 1955.

The early phase of the acute radiation syndrome has much in common with the response of the body to nonspecific stresses. The role of the adrenal cortex in the response to radiation is not clear. While adrenal cholesterol and ascorbic acid decrease following acute whole-body irradiation, the hematologic changes usually described are unlike those accompanying acute adrenal stimulation. The authors' studies in the Rhesus monkey suggest that these descriptions are misleading. In the hours immediately following whole-body x-irradiation they found the classic response to non-specific stress, including a rise in plasma 17-hydroxysteroid levels, granulocytosis, lymphopenia, and eosinopenia. These changes are related to dose and are transient. If studies are begun on the day following irradiation, they are missed entirely. After the first day, the monkeys showed the pancytopenia which has been observed since the earliest investigations of the radiation syndrome.

Three figures; 1 chart.

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